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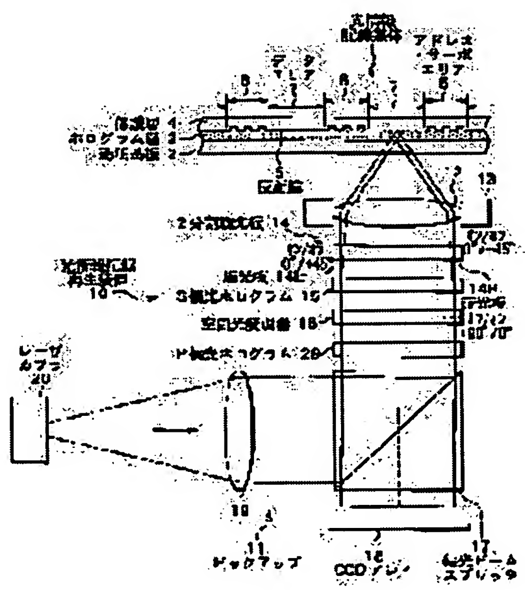
(54) OPTICAL INFORMATION RECORDING DEVICE AND METHOD, OPTICAL INFORMATION REPRODUCING DEVICE AND METHOD, AND OPTICAL INFORMATION RECORDING MEDIUM

(57)Abstract:
PROBLEM TO BE SOLVED: To make an optical recording and reproducing system small in configuration.
SOLUTION: During recording, the emitted light of a laser coupler 20 is modulated by a spacer optical modulator 16 based on a difference in polarizing direction, the light is divided into an information light and a reference light by an S polarization hologram 15 by making converging positions different from each other based on the polarizing direction, the information light and the reference light are rotary-rotated to have the same polarization direction with each other by a bisected rotary polarizing plate 14 in an area where the information light and the reference light overlap each other in a halogen layer 3 and, by irradiating the hologram layer 3 with light via an objective lens 12, an interference pattern is recorded. During reproduction, the hologram layer 3 is irradiated with the reference light, a primary reproducing light produced by this reference light produces a secondary reproducing light by using the light reflected



on a reflection layer 5 as a secondary reference light and the pattern of this secondary reproducing light is detected by a CCD array 18.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the optical information record medium used by the optical information regenerative apparatus which reproduces information from an optical information record medium using the optical information recording device which records information on an optical information record medium using holography and an approach, and holography, an approach, these light information recording device and the approach or the optical information regenerative apparatus, and the approach.
[0002]
[Description of the Prior Art] Holographic record which records information on a record medium using holography is performed by writing the interference fringe which can generally do light with image information, and a reference beam superposition and then inside a record medium in a record medium. At the time of playback of the recorded information, image information is reproduced by irradiating a reference beam at the record medium by diffraction by the interference fringe.
[0003] In recent years, for super-high density optical recording, volume holography, especially digital volume holography are developed in a practical use region, and attract attention. Volume holography is a method with which it utilizes positively and the thickness direction of a record medium also writes in an interference fringe in three dimension, diffraction efficiency is raised by increasing thickness and there is the description that buildup of storage capacity can be aimed at using multiplex record. And with digital volume holography, although volume holography, the same record medium, and a recording method are used, the image information to record is the computer-oriented holographic recording method limited to the digital pattern made binary. In this digital volume holography, it once digitizes, and develops to two-dimensional digital pattern information, and image information like an analog--, for example picture also records this as image information. At the time of playback, it is reading and decoding this digital pattern information, and it is returned and displayed on the original image information. It becomes possible to reproduce the information on original very faithfully by performing differential detection, or coding binary-ized data and performing an error correction by this, at the time of playback, even if an SN ratio (S/N) is somewhat bad.
[0004] Drawing 38 is the perspective view showing the configuration of the outline of the record reversion system in the conventional digital volume holography. The space optical modulator 101 with which this record reversion system generates the information light 102 based on two-dimensional digital pattern information, The lens 103 which the information light 102 from this space optical modulator 101 is condensed, and is irradiated to the hologram record medium 100, A reference beam exposure means to irradiate a reference beam 104 from the direction which carries out an abbreviation rectangular cross with the information light 102 to the hologram record medium 100 (not shown), It has the lens 106 which condenses the playback light 105 by which outgoing radiation is carried out from the CCD (charge-coupled device) array 107 and the hologram record medium 100 for detecting the reproduced two-dimensional digital pattern information, and irradiates on the CCD array 107. the hologram record medium 100 -- LiNbO3 etc. -- a crystal is used.
[0005] In the record reversion system shown in drawing 38 , at the time of record, the information on the subject-copy image to record is digitized, the signal of 0 or 1 is further arranged to two-

dimensional, and two-dimensional digital pattern information is generated. One two-dimensional digital pattern information is called page data. Here, multiplex record of the page data of #1 - #n shall be carried out at the same hologram record medium 100. In this case, first, based on page data #1, by choosing transparency or protection from light for every pixel with the space optical modulator 101, the information light 102 modulated spatially is generated and the hologram record medium 100 is irradiated through a lens 103. Simultaneously, a reference beam 104 is irradiated from the direction theta 1 which carries out an abbreviation rectangular cross with the information light 102, and the interference fringe made by the superposition of the information light 102 and a reference beam 104 inside the hologram record medium 100 is recorded on the hologram record medium 100. In addition, in order to raise diffraction efficiency, a reference beam 104 deforms into a flat beam by a cylindrical lens etc., and an interference fringe crosses even in the thickness direction of the hologram record medium 100, and is recorded. At the time of the following record of page data #2, a reference beam 104 is irradiated from a different include angle theta 2 from theta 1, and multiplex record of the information can be carried out to the same hologram record medium 100 by piling up this reference beam 104 and the information light 102. Similarly, at the time of record of other page data #3 - #n, a reference beam 104 is irradiated from include-angle theta3-thetan different, respectively, and multiplex record of the information is carried out. Thus, information calls a stack the hologram by which multiplex record was carried out. In the example shown in drawing 38 , the hologram record medium 100 has two or more stacks (a stack 1, a stack 2, --, Stack m, --).
[0006] What is necessary is just to irradiate the reference beam 104 of whenever [same incident angle / as the time of recording the page data] at the stack, in order to reproduce the page data of arbitration from a stack. If it does so, the reference beam 104 will be selectively diffracted by the interference fringe corresponding to the page data, and the playback light 105 will generate it by it. Incidence of this playback light 105 is carried out to the CCD array 107 through a lens 106, and the two-dimensional pattern of playback light is detected by the CCD array 107. And the information on a subject-copy image etc. is reproduced by decoding the two-dimensional pattern of the detected playback light conversely with the time of record.
[0007]
[Problem(s) to be Solved by the Invention] Although multiplex record of the information can be carried out with the configuration shown in drawing 38 at the same hologram record medium 100, in order to record information on super-high density, positioning of the information light 102 and the reference beam 104 to the hologram record medium 100 becomes important. However, with the configuration shown in drawing 38 , since there is no information for positioning in hologram record-medium 100 the very thing, positioning of the information light 102 and the reference beam 104 to the hologram record medium 100 must be performed mechanically, and high positioning of precision is difficult. Therefore, while a remover kinky thread tee (ease of moving a hologram record medium from a certain record regenerative apparatus to other record regenerative apparatus, and performing same record playback) is bad and random access is difficult, there is a trouble that high density record is difficult. Furthermore, with the configuration shown in drawing 38 , since each optical axis of the information light 102, a reference beam 104, and the playback light 105 is arranged in a location which is mutually different spatially, there is a trouble that optical system is enlarged.
[0008] This invention was made in view of this trouble, and the 1st object is in offering the optical information recording device which enabled it to constitute the optical system for record or playback small and an approach, an optical information regenerative apparatus, an approach, and an optical information record medium.
[0009] The 2nd object of this invention is to offer the optical information recording device and approach of having enabled it to position light for the record over an optical information record medium, or playback with a sufficient precision, an optical information regenerative apparatus, an approach, and an optical information record medium in addition to the 1st object of the above.
[0010]
[Means for Solving the Problem] The light source which carries out outgoing radiation of the flux of light which the optical information recording device of this invention is an optical information recording device for recording information to the optical information record medium equipped with

the information recording layer on which information is recorded using holography, and is irradiated by the optical information record medium, So that information may be recorded on a space modulation means to modulate spatially a part of flux of light [at least] by which outgoing radiation was carried out from this light source, and to generate information light and the reference beam for record, and an information recording layer, with the interference pattern by interference with information light and the reference beam for record It has the record optical system which irradiates the information light and the reference beam for record which were generated by the space modulation means from the same field side to an information recording layer.
[0011] The light source which carries out outgoing radiation of the flux of light which the optical information regenerative apparatus of this invention is an optical information regenerative apparatus for reproducing information from the optical information record medium equipped with the information recording layer on which information was recorded using holography, and is irradiated by the optical information record medium, While generating the reference beam for playback and irradiating to an information recording layer from the flux of light by which outgoing radiation was carried out from this light source It has the playback optical system which collects the playback light generated from an information recording layer from the same field side as the side which irradiates the reference beam for playback to an information recording layer, and a detection means to detect the playback light collected according to this playback optical system, by irradiating the reference beam for playback.
[0012] The optical information record approach of this invention is the optical information record approach for recording information to the optical information record medium equipped with the information recording layer on which information is recorded using holography. So that a part of flux of light [at least] by which outgoing radiation was carried out from the light source may be modulated spatially, information light and the reference beam for record may be generated and information may be recorded on an information recording layer with the interference pattern by interference with information light and the reference beam for record Information light and the reference beam for record are irradiated from the same field side to an information recording layer.
[0013] The optical information playback approach of this invention is the optical information playback approach for reproducing information from the optical information record medium equipped with the information recording layer on which information was recorded using holography. From the flux of light by which outgoing radiation was carried out from the light source, generate the reference beam for playback and it irradiates to an information recording layer. By irradiating the reference beam for playback, the playback light generated from an information recording layer is collected from the same field side as the side which irradiates the reference beam for playback to an information recording layer, and the collected playback light is detected.
[0014] The optical information record medium of this invention is equipped with the information recording layer for generating the playback light corresponding to the information currently recorded in the same field side as the reference beam for playback when the reference beam for playback is irradiated, while information is recorded using holography with the interference pattern by interference with information light and the reference beam for record.
[0015] In the optical information recording device of this invention, a part of flux of light [at least] by which outgoing radiation was carried out from the light source is spatially modulated by the space modulation means, information light and the reference beam for record are generated, this information light and the reference beam for record are irradiated by record optical system from the same field side to an information recording layer, and information is recorded on an information recording layer with the interference pattern by interference with information light and the reference beam for record.
[0016] While the reference beam for playback is generated by playback optical system and this reference beam for playback is irradiated to an information recording layer in the optical information regenerative apparatus of this invention from the flux of light by which outgoing radiation was carried out from the light source By irradiating the reference beam for playback, it is collected from the field side as the side which irradiates the reference beam for playback to an information recording layer where the playback light generated from an information recording layer is the same, and this collected playback light is detected by the detection means.

[0017] By the optical information record approach of this invention, a part of flux of light [at least] by which outgoing radiation was carried out from the light source is modulated spatially, information light and the reference beam for record are generated, information light and the reference beam for record are irradiated from the same field side to an information recording layer, and information is recorded on an information recording layer with the interference pattern by interference with information light and the reference beam for record.
[0018] The playback light which the playback light generated from an information recording layer was collected from the same field side as the side which irradiates the reference beam for playback to an information recording layer, and collected is detected by generating the reference beam for playback, being irradiated this reference beam for playback to an information recording layer, and being irradiated the reference beam for playback by the optical information playback approach of this invention from the flux of light by which outgoing radiation was carried out from the light source.
[0019] In the optical information record medium of this invention, when information is recorded on an information recording layer with the interference pattern by interference with information light and the reference beam for record and the reference beam for playback is irradiated by this information recording layer, the playback light corresponding to the information currently recorded is generated at the same field side as the reference beam for playback.
[0020]
[Embodiment of the Invention] Hereafter, the gestalt of operation of this invention is explained to a detail with reference to a drawing. The explanatory view showing the configuration of the optical information record medium concerning the gestalt of operation of the 1st of the pickup in the optical information record regenerative apparatus as the optical information recording device which drawing 1 requires for the gestalt of operation of the 1st of this invention, and an optical information regenerative apparatus, and this invention, and drawing 2 are the block diagrams showing the whole optical information record regenerative-apparatus configuration concerning the gestalt of this operation.
[0021] With reference to introduction and drawing 1 , the configuration of the optical information record medium concerning the gestalt of this operation is explained. This optical information record medium 1 carries out the laminating of the hologram layer 3 as an information recording layer by which information is recorded on the whole surface of the disc-like transparence substrate 2 formed of the polycarbonate etc. using volume holography, the reflective film 5, and the protective layer 4 in this sequence, and is constituted. The address servo area 6 as two or more positioning fields which extend in a line radially is established in the interface of the hologram layer 3 and a protective layer 4 at intervals of a predetermined include angle, and the section of the sector between the adjacent address servo area 6 has become a data area 7. Information and address information for a sample DOSABO method to perform a focus servo and a tracking servo are beforehand recorded on the address servo area 6 by the embossing pit etc. In addition, a focus servo can be performed using the reflector of the reflective film 5. As information for performing a tracking servo, a WOPURU pit can be used, for example. The transparence substrate 2 makes the proper thickness of 0.6mm or less, and the hologram layer 3 the proper thickness of 10 micrometers or more. The hologram layer 3 is formed with the hologram ingredient from which optical properties, such as a refractive index, a dielectric constant, and a reflection factor, change according to luminous intensity, when light is irradiated. as a hologram ingredient -- for example, the E. I. du Pont de Nemours& Co. (Dupont) make -- photopolymer (photopolymers) HRF-600 (product name) etc. is used. The reflective film 5 is formed of aluminum.
[0022] Next, the configuration of the optical information record regenerative apparatus concerning the gestalt of this operation is explained. This optical information record regenerative apparatus 10 is equipped with the spindle 81 with which the optical information record medium 1 is attached, the spindle motor 82 made to rotate this spindle 81, and the spindle servo circuit 83 which controls a spindle motor 82 to maintain the number of revolutions of the optical information record medium 1 at a predetermined value as shown in drawing 2 . While the optical information record regenerative apparatus 10 irradiates information light and the reference beam for record to the optical information record medium 1 and records information further The reference beam for playback was irradiated to

the optical information record medium 1, playback light was detected, and it has the driving gear 84 of the optical information record medium 1 radially made movable for the pickup 11 for reproducing the information currently recorded on the optical information record medium 1, and this pickup 11.

[0023] The detector 85 for the optical information record regenerative apparatus 10 to detect focal error signal FE, the tracking error signal TE, and a regenerative signal RF from the output signal of pickup 11 further, It is based on focal error signal FE detected by this detector 85. The focus servo circuit 86 which drives the actuator in pickup 11, is made to move an objective lens in the thickness direction of the optical information record medium 1, and performs a focus servo, The tracking servo circuit 87 which drives the actuator in pickup 11 based on the tracking error signal TE detected by the detector 85, is made to move an objective lens to radial [of the optical information record medium 1], and performs a tracking servo, It has the slide servo circuit 88 which performs the slide servo which a driving gear 84 is controlled [servo] based on the command from the tracking error signal TE and the controller mentioned later, and moves pickup 11 to radial [of the optical information record medium 1].

[0024] The optical information record regenerative apparatus 10 decoded further the output data of a CCD array later mentioned in pickup 11, and is equipped with the digital disposal circuit 89 which reproduces the data recorded on the data area 7 of the optical information record medium 1, reproduces a basic clock from the regenerative signal RF from a detector 85, or distinguishes the address, and the controller 90 which controls the optical whole information record regenerative apparatus 10. A controller 90 controls pickup 11, the spindle servo circuit 83, and slide servo circuit 88 grade while inputting the basic clock and address information which are outputted from a digital disposal circuit 89. The spindle servo circuit 83 inputs the basic clock outputted from a digital disposal circuit 89.

[0025] A detector 85, the focus servo circuit 86, the tracking servo circuit 87, and the slide servo circuit 88 correspond to the position control means in this invention. Moreover, a digital disposal circuit 89 corresponds to the criteria location distinction means in this invention.

[0026] As shown in drawing 1 , when the optical information record medium 1 is fixed to a spindle 81, pickup 11 The objective lens 12 which counters the transparence substrate 2 side of the optical information record medium 1, and this objective lens 12 The thickness direction and the radially movable actuator 13 of the optical information record medium 1, 2 division rotatory-polarization plate 14 arranged in the opposite hand of the optical information record medium 1 in an objective lens 12 sequentially from the objective lens 12 side, S polarization hologram 15, the space optical modulator 16, P polarization hologram 28, a polarization beam splitter 17, and the CCD array 18, It has the collimator lens 19 arranged between the laser coupler 20 arranged in the side of a polarization beam splitter 17, and this laser coupler 20 and polarization beam splitter 17. S polarization hologram 15 corresponds to the separation means in this invention.

[0027] The laser coupler 20 carries out outgoing radiation of the laser beam of S polarization, and after this laser beam is made the parallel flux of light by the collimator lens 19, carries out incidence to a polarization beam splitter 17, is reflected by this polarization beam splitter 17 and it passes P polarization hologram 28, the space optical modulator 16, S polarization hologram 15, and 2 division rotatory-polarization plate 14 in order, it is condensed with an objective lens 12 and it is irradiated by the optical information record medium 1. Moreover, after it passes an objective lens 12, 2 division rotatory-polarization plate 14, S polarization hologram 15, the space optical modulator 16, and P polarization hologram 28 in order, incidence of the return light from the optical information record medium 1 is carried out to a polarization beam splitter 17, and only the light of P polarization of them penetrates a polarization beam splitter 17, and carries out incidence of it to the CCD array 18. In addition, S polarization is the linearly polarized light with the polarization direction vertical to plane of incidence (space of drawing 1), and P polarization is the linearly polarized light with the polarization direction parallel to plane of incidence.

[0028] 2 division rotatory-polarization plate 14 has rotatory-polarization plate 14L arranged in drawing 1 at a part for the left flank of an optical axis, and rotatory-polarization plate 14R arranged in drawing 1 at a part for the right flank of an optical axis. The rotatory-polarization plates 14L and 14R enclose liquid crystal, for example between two transparent electrode substrates, respectively, and are constituted. rotatory-polarization plate 14L -- between two transparent electrode substrates --

an electrical potential difference -- not impressing (it being said hereafter that it turns OFF.) -- the +45 degrees of the polarization directions are rotated -- making -- between two transparent electrode substrates -- an electrical potential difference -- impressing (it being said hereafter that it turns ON.) -- the polarization direction is not rotated. On the other hand, if rotatory-polarization plate 14R is turned OFF, it will rotate the -45 degrees of the polarization directions, and if it turns ON, it will not rotate the polarization direction.

[0029] S polarization hologram 15 has the lens function as which light is completed only to S polarization. And it converges so that the hologram layer 3 may be passed this P polarization passing S polarization hologram 15 with the parallel flux of light when P polarization of the parallel flux of light carries out incidence to S polarization hologram 15 from the space optical modulator 16 side, and being condensed with an objective lens 12, and the optical information record medium 1 irradiating, and converging and it may become a minor diameter most on the interface of the hologram layer 3 and a protective layer 4. The hologram layer 3 is passed emitting, after converging so that it may be condensed with the objective lens 12 after S polarization hologram 15 converged this S polarization a little, when S polarization of the parallel flux of light carried out incidence to S polarization hologram 15 on the other hand than the space optical modulator 16 side, the optical information record medium 1 may irradiate and it may once become a minor diameter from the interface of the hologram layer 3 and a protective layer 4 most by the near side. On the other hand, P polarization hologram 28 has the lens function as which light is completed only to P polarization.

[0030] The space optical modulator 16 has the pixel of a large number arranged in the shape of a grid, and can modulate light now spatially by the difference in the polarization direction by choosing the polarization direction of outgoing radiation light for every pixel. Specifically, the space optical modulator 16 is a configuration equivalent to the thing except a polarizing plate in the liquid crystal display component using the optical activity of liquid crystal. Here, for every pixel, if the space optical modulator 16 is turned OFF, it will rotate the +90 degrees of the polarization directions, and if it turns ON, it will not rotate the polarization direction. As liquid crystal in the space optical modulator 16, strong dielectric liquid crystal with a quick (an microsecond of order) speed of response can be used, for example. It becomes possible to attain high-speed record by this, for example, to record the information for 1 page by several micro or less.

[0031] The perspective view and drawing 4 which show the configuration of the laser coupler [in / in drawing 3 / drawing 1] 20 are the side elevation of the laser coupler 20. As shown in these drawings, the laser coupler 20 The semi-conductor substrate 21 with which photodetectors 25 and 26 were formed, and the prism 22 which has been arranged so that photodetectors 25 and 26 may be covered on this semi-conductor substrate 21, and was joined on the semi-conductor substrate 21, It has been arranged in the location where photodetectors 25 and 26 were formed on the semi-conductor substrate 21, and a different location, and has the semiconductor device 23 joined on the semi-conductor substrate 21, and the semiconductor laser 24 joined on this semiconductor device 23. Semiconductor laser 24 carries out outgoing radiation of the back laser beam to a front laser beam and an opposite direction while carrying out outgoing radiation of the front laser beam horizontally towards a prism 22 side. A slant face is formed in the semiconductor laser 24 side of prism 22, and this slant face is half-reflector 22a which penetrates a part of return light from the optical information record medium 1 while it reflects a part of front laser beam from semiconductor laser 24 and it carries out outgoing radiation in the vertical direction to the semi-conductor substrate 21. Moreover, the top face of prism 22 is total reflection side 22b which carries out total reflection of the light which passes through the inside of prism 22 as shown in drawing 4 . The photodetector 27 which receives the back laser beam from semiconductor laser 24 is formed in the semiconductor device 23. The output signal of this photodetector 27 is used in order to carry out regulating automatically of the output of semiconductor laser 24. Various kinds of amplifier and other electronic parts are built in the semi-conductor substrate 21. Electronic parts, such as amplifier which drives semiconductor laser 24, are built in the semiconductor device 23.

[0032] In the laser coupler 20 shown in drawing 3 and drawing 4 , a part is reflected by half-reflector 22a of prism 22, and incidence of the front laser beam from semiconductor laser 24 is carried out to the collimator lens 19 in drawing 1 . Moreover, a part penetrates half-reflector 22a of prism 22, and the return light from the optical information record medium 1 condensed by the collimator lens 19 is

drawn in prism 22, and goes to a photodetector 25. The half-reflective film is formed on the photodetector 25, a part of light drawn in prism 22 penetrates the half-reflective film on a photodetector 25, and it carries out incidence to a photodetector 25, and it is reflected by the half-reflective film on a photodetector 25, it is further reflected by total reflection side 22b of prism 22, and incidence of the remaining parts is carried out to a photodetector 26.

[0033] Here, as shown in drawing 4 , the light drawn in prism 22 is converged so that it may once become a minor diameter most in the middle of the optical path between a photodetector 25 and 26. And the path of the incident light to photodetectors 25 and 26 becomes equal in the focus condition converged so that the light from the laser coupler 20 may serve as a minor diameter most on the interface of the hologram layer 3 in the optical information record medium 1, and a protective layer 4, and when it separates from a focus condition, the paths of the incident light to photodetectors 25 and 26 differ. Since change of the path of the incident light to photodetectors 25 and 26 becomes hard flow mutually, a focal error signal can be obtained by detecting the signal according to change of the path of the incident light to photodetectors 25 and 26. As shown in drawing 3 , photodetectors 25 and 26 have the light sensing portion trichotomized, respectively. Let light sensing portions [in / for the light sensing portion in a photodetector 25 / A1, C1, B1, and a photodetector 26] be A2, C2, and B-2. C1 and C2 are the light sensing portions for a center section between A1 and B1 and between A2 and B-2, respectively. Moreover, the parting line between each light sensing portion is arranged so that it may become the direction and parallel corresponding to the direction of a truck in the optical information record medium 1. therefore, PUYUSSHUPURU from the difference of the output between a light sensing portion A1 and B1 and between A2 and B-2 -- a tracking error signal can be acquired by law.

[0034] In addition, control of the output of the semiconductor laser 24 in the laser coupler 20 and control of 2 division rotatory-polarization plate 14 and the space optical modulator 16 are performed under control of the controller 90 in drawing 1 by the actuation circuit which is not illustrated, respectively.

[0035] Drawing 5 is the block diagram showing the configuration of the detector 85 for detecting a focal error signal, a tracking error signal, and a regenerative signal based on the output of photodetectors 25 and 26. The adder 31 with which this detector 85 adds each output of the light sensing portions A1 and B1 of a photodetector 25, The gain control amplifier 32 which adjusts the gain of the output of this adder 31, and the gain control amplifier 33 which adjusts the gain of the output of the light sensing portion C1 of a photodetector 25, The subtractor 34 which calculates the difference of the output of the gain control amplifier 32, and the output of the gain control amplifier 33, The light sensing portion A2 of a photodetector 26, and the adder 35 adding each output of B-2, The gain control amplifier 36 which adjusts the gain of the output of this adder 35, and the gain control amplifier 37 which adjusts the gain of the output of the light sensing portion C2 of a photodetector 26, It has the subtractor 38 which calculates the difference of the output of the gain control amplifier 36, and the output of the gain control amplifier 37, and the subtractor 39 which calculates the difference of the output of a subtractor 34, and the output of a subtractor 38, and generates focal error signal FE.

[0036] The detector 85 is further equipped with the subtractor 40 which calculates the difference of the output of the light sensing portion A1 of a photodetector 25, and the output of a light sensing portion B1, the subtractor 41 which calculates the difference of the output of the light sensing portion A2 of a photodetector 26, and the output of light sensing portion B-2, and the subtractor 42 which calculates the difference of the output of a subtractor 40, and the output of a subtractor 41, and generates the tracking error signal TE. The detector 85 is equipped with the adder 45 which adds the adder 44 which adds the adder 43 adding the output of an adder 31, and the output of a light sensing portion C1, and the output of an adder 35 and the output of a light sensing portion C2 further, and the output of an adder 43 and the output of an adder 44, and generates a regenerative signal RF. In addition, with the gestalt of this operation, a regenerative signal RF is a signal which reproduced the information recorded on the address servo area 6 in the optical information record medium 1.

[0037] Next, at the time of a servo, at the time of record, it divides at the time of playback and an operation of the optical information record regenerative apparatus concerning the gestalt of this operation and an optical information record medium is explained in order. In addition, at the time of

a servo, at the time of record, it is controlled to maintain a regular rotational frequency also at the time of any at the time of playback, and the optical information record medium 1 rotates it with a spindle motor 82.

[0038] First, the operation at the time of a servo is explained. The explanatory view and drawing 8 which show the condition of the pickup [drawing 6] 11 at the time of a servo are the explanatory view showing the condition of the light at the time of a servo. As shown in these drawings, at the time of a servo, all the pixels of the space optical modulator 16 are turned OFF, and each rotatory-polarization plates 14L and 14R of 2 division rotatory-polarization plate 14 are turned ON. The output of the outgoing radiation light of the laser coupler 20 is set as the low-power output fcr playback. In addition, a controller 90 is considered as the above-mentioned setting out, while the timing to which the outgoing radiation light of an objective lens 12 passes through the address servo area 6 is predicted based on the basic clock reproduced from the regenerative signal RF and the outgoing radiation light of an objective lens 12 passes through the address servo area 6.

[0039] By the collimator lens 19, the laser beam of S polarization by which outgoing radiation was carried out from the laser coupler 20 is made into the parallel flux of light, and carries out incidence to a polarization beam splitter 17, and it is reflected by this polarization beam splitter 17, and it passes P polarization hologram 28, without being influenced at all, and it carries out incidence to the space optical modulator 16. Here, since all the pixels of the space optical modulator 16 are turned OFF, the +90 degrees of the polarization directions rotate, and the light after passing the space optical modulator 16 turns into P polarization. In addition, the notation shown with the sign 51 in drawing 8 expresses S polarization, and the notation shown with the sign 52 expresses P polarization. The light of P polarization after passing the space optical modulator 16 passes S polarization hologram 15, without being influenced at all, and it carries out incidence to 2 division rotatory-polarization plate 14. Here, since both the rotatory-polarization plates 14L and 14R of 2 division rotatory-polarization plate 14 are turned ON, light passes 2 division rotatory-polarization plate 14, without being influenced at all. It is condensed with an objective lens 12, and the light which passed 2 division rotatory-polarization plate 14 is irradiated by the information record medium 1 so that it may become a minor diameter most on the interface of the hologram layer 3 in the optical information record medium 1, and a protective layer 4 and may converge. It is reflected by the reflective film 5 of the information record medium 1, and in that case, the embossing pit in the address servo area 6 becomes irregular, and this light returns to an objective lens 12 side. This return light is made into the parallel flux of light with an objective lens 12, 2 division rotatory-polarization plate 14 and S polarization hologram 15 are passed without being influenced at all, and incidence is carried out to the space optical modulator 16. Here The polarization direction rotates and it considers as S polarization again, and P polarization hologram 28 is passed without being influenced at all, it is reflected by the polarization beam splitter 17, incidence is carried out to the laser coupler 20, and it is detected by photodetectors 25 and 26. And while focal error signal FE, the tracking error signal TE, and a regenerative signal RF are generated by the detector 85 shown in drawing 5 and a focus servo and a tracking servo are performed based on these signals based on the output of these photodetectors 25 and 26, playback of a basic clock and distinction of the address are performed.

[0040] In addition, in setting out at the time of the above-mentioned servo, the configuration of pickup 11 becomes being the same as that of the configuration of pickup of for [to the usual optical disks, such as CD (compact disc), DVD (digital videodisc), and HS (hyper-storage disk), / record and for playback]. Therefore, it is also possible to constitute from an optical information record regenerative apparatus 10 in the gestalt of this operation so that compatibility with the usual optical disk unit may be given.

[0041] Here, A polarization and B polarization which are used by next explanation are defined as follows. That is, as shown in drawing 7 , A polarization is made into the linearly polarized light which rotated [S polarization] the +45-degree polarization direction for -45 degrees or P polarization, and B polarization makes S polarization the linearly polarized light which rotated the -45-degree polarization direction for +45 degrees or P polarization. As for A polarization and B polarization, the polarization direction lies at right angles mutually.

[0042] Next, the operation at the time of record is explained. The explanatory view, drawing 10 , and drawing 11 which show the condition of the pickup [drawing 9 / R> 9] 11 at the time of record are

the explanatory view showing the condition of the light at the time of record. As shown in these drawings, at the time of record, the space optical modulator 16 chooses OFF and ON for every pixel according to the information to record. The gestalt of this operation expresses 1-bit information by 2 pixels. In this case, one side of the 2 pixels corresponding to 1-bit information is turned on, and another side is surely made off. Moreover, both the rotatory-polarization plates 14L and 14R of 2 division rotatory-polarization plate 14 are turned OFF. The output of the outgoing radiation light of the laser coupler 20 is made into the high power for record in pulse. In addition, a controller 90 is considered as the above-mentioned setting out, while the timing to which the outgoing radiation light of an objective lens 12 passes a data area 7 is predicted based on the basic clock reproduced from the regenerative signal RF and the outgoing radiation light of an objective lens 12 passes a data area 7. While the outgoing radiation light of an objective lens 12 passes a data area 7, a focus servo and a tracking servo are not performed, but the objective lens 12 is being fixed.

[0043] By the collimator lens 19, the laser beam of S polarization by which outgoing radiation was carried out from the laser coupler 20 is made into the parallel flux of light, and carries out incidence to a polarization beam splitter 17, and it is reflected by this polarization beam splitter 17, and it passes P polarization hologram 28, without being influenced at all, and it carries out incidence to the space optical modulator 16. Here, the light which passed the pixel turned ON among the space optical modulators 16 serves as as [S polarization], without the polarization direction rotating, the +90 degrees of the polarization directions rotate, and the light which passed the pixel turned OFF turns into P polarization. Incidence of the light after passing the space optical modulator 16 is carried out to S polarization hologram 15. Here, since S polarization hologram 15 completes only S polarization, P polarization component of the light from the space optical modulator 16 is converged, passing S polarization hologram 15 with the parallel flux of light, and being condensed with an objective lens 12, and the optical information record medium 1 irradiating, and converging so that the hologram layer 3 may be passed and it may become a minor diameter most on the interface of the hologram layer 3 and a protective layer 4. On the other hand, it is condensed with an objective lens 12 and S polarization component of the light from the space optical modulator 16 is irradiated by the optical information record medium 1, after being completed a little by S polarization hologram 15, and after converging so that it may once become a minor diameter from the interface of the hologram layer 3 and a protective layer 4 most by the near side, it passes the hologram layer 3, emitting. With the gestalt of this operation, make into the reference beam for record light converged so that it may become a minor diameter most on the interface of the hologram layer 3 and a protective layer 4, and let light converged so that it may become a minor diameter from the interface of the hologram layer 3 and a protective layer 4 most by the near side be information light.

[0044] The polarization direction rotates a part for +45 degrees of left flanks of an optical axis among the flux of lights from S polarization hologram 15 by rotatory-polarization plate 14L of 2 division rotatory-polarization plate 14, and the polarization direction rotates a part for -45 degrees of right flanks of an optical axis by rotatory-polarization plate 14R of 2 division rotatory-polarization plate 14. The flux of light which passed the off pixel of the space optical modulator 16, and passed rotatory-polarization plate 14L here is described as reference beam OFF-L. The flux of light which similarly passed the pixel of ON of the space optical modulator 16, and passed rotatory-polarization plate 14L Information light ON-L, The flux of light which passed the pixel of ON of the flux of light which passed the off pixel of the space optical modulator 16, and passed rotatory-polarization plate 14R of reference beam OFF-R and the space optical modulator 16, and passed rotatory-polarization plate 14R is described as information light ON-R. As shown in drawing 10 , reference beam OFF-L passes rotatory-polarization plate 14L, and serves as light of A polarization, and information light ON-R passes rotatory-polarization plate 14R, and serves as light of A polarization. In addition, the notation shown with the sign 53 in drawing 10 expresses A polarization. Moreover, as shown in drawing 11 , reference beam OFF-R passes rotatory-polarization plate 14R, and serves as light of B polarization, and information light ON-L passes rotatory-polarization plate 14L, and serves as light of B polarization. In addition, the notation shown with the sign 54 in drawing 11 expresses B polarization. With the gestalt of this operation, information is recorded on the hologram layer 3 using four kinds of above-mentioned flux of lights. The record approach of this information is explained in detail with reference to drawing 10 and drawing 11 .

[0045] Drawing 10 shows the situation of interference with reference beam OFF-L and information light ON-R. As shown in this drawing, in the field on the left-hand side of an optical axis, reference beam OFF-L passes the hologram layer 3, converging, information light ON-R passes the hologram layer 3, emitting, and since both such light is A polarization, it interferes in them. And when the output of the outgoing radiation light of the laser coupler 20 turns into high power, the interference pattern of reference beam OFF-L and information light ON-R is recorded in volume in the hologram layer 3. In addition, although reference beam OFF-R also passes the light reflected by the reflective film 5 in the field on the left-hand side of an optical axis, this reference beam OFF-R is B polarization, and since A polarization and the polarization direction cross at right angles, it does not interfere with reference beam OFF-L of A polarization, and information light ON-R.
[0046] Drawing 11 shows the situation of interference with reference beam OFF-R and information light ON-L. As shown in this drawing, in the field on the right-hand side of an optical axis, reference beam OFF-R passes the hologram layer 3, converging, information light ON-L passes the hologram layer 3, emitting, and since both such light is B polarization, it interferes in them. And when the output of the outgoing radiation light of the laser coupler 20 turns into high power, the interference pattern of reference beam OFF-R and information light ON-L is recorded in volume in the hologram layer 3. In addition, although reference beam OFF-L also passes the light reflected by the reflective film 5 in the field on the right-hand side of an optical axis, this reference beam OFF-L is A polarization, and since B polarization and the polarization direction cross at right angles, it does not interfere with reference beam OFF-R of B polarization, and information light ON-L.
[0047] Thus, with the gestalt of this operation, in the field on the left-hand side of an optical axis, and a right-hand side field, since the polarization direction of the light made to interfere is made to intersect perpendicularly, generating of an excessive interference fringe can be prevented and lowering of an SN ratio can be prevented.
[0048] In addition, although there is also information light which an interference fringe does not produce with the gestalt of this operation since the reference beam for record of a pixel unit does not exist in the information light of a pixel unit when one cross section of the hologram layer 3 is seen, since the reference beam for record is also the light spatially modulated by the space optical modulator 16 Since such an information light also passes the part to which the reference beam for record of a pixel unit surely exists in the hologram layer 3 and generates an interference fringe, a problem is not produced. In addition, in the space optical modulator 16, 1-bit information is expressed by 2 pixels, one side of the 2 pixels corresponding to 1-bit information is turned on, and another side is made off. Therefore, the quantity of light of the reference beam for record serves as abbreviation regularity irrespective of the informational content. Drawing 12 expresses notionally signs that the reference beam 55 for record of a pixel unit and the information light 56 of a pixel unit interfere in volume in the hologram layer 3. Since it is easy, this drawing shows the example by which the reference beam 55 for record of a pixel unit and the information light 56 of a pixel unit have been arranged by turns. At this example, the reference beam 55 for record of a pixel unit is mutually different include angles theta1 and theta3, --, thetan-3, and thetan-1. They are the include angle theta 2 from which it is the convergence light which it has, and the information light 56 of a pixel unit differs mutually, theta 4, --, thetan-2, and thetan. It is the divergence light which it has. As shown in this drawing, the information light 56 of each pixel unit surely crosses with the reference beam 55 for record of one of pixel units in the hologram layer 3, and generates an interference fringe.
[0049] Moreover, with the gestalt of this operation, since both information light and the reference beam for record advance from the same field side of the hologram layer 3 to the field side of another side, the hologram of a transparency mold (Fresnel mold) is formed in the hologram layer 3. In the hologram of a transparency mold, if the reference beam for playback is irradiated from one field side of the hologram layer 3, outgoing radiation of the playback light will be carried out to the field side of another side of the hologram layer 3.
[0050] Next, the operation at the time of playback is explained. The explanatory view, drawing 14, or drawing 17 which shows the condition of the pickup [drawing / 1313] 11 at the time of playback is the explanatory view showing the condition of the light at the time of playback. As shown in these drawings, at the time of playback, all the pixels of the space optical modulator 16 are turned ON, and

each rotatory-polarization plates 14L and 14R of 2 division rotatory-polarization plate 14 are turned OFF. The output of the outgoing radiation light of the laser coupler 20 is set as the low-power output for playback. In addition, a controller 90 is considered as the above-mentioned setting out, while the timing to which the outgoing radiation light of an objective lens 12 passes a data area 7 is predicted based on the basic clock reproduced from the regenerative signal RF and the outgoing radiation light of an objective lens 12 passes a data area 7. While the outgoing radiation light of an objective lens 12 passes a data area 7, a focus servo and a tracking servo are not performed, but the objective lens 12 is being fixed.

[0051] By the collimator lens 19, the laser beam of S polarization by which outgoing radiation was carried out from the laser coupler 20 is made into the parallel flux of light, and carries out incidence to a polarization beam splitter 17, and it is reflected by this polarization beam splitter 17, and it passes P polarization hologram 28, without being influenced at all, and it carries out incidence to the space optical modulator 16. Here, since all the pixels of the space optical modulator 16 are turned ON, the polarization direction does not rotate but the light after passing the space optical modulator 16 continues being S polarization. It is condensed with an objective lens 12 and the light of S polarization after passing the space optical modulator 16 is irradiated by the optical information record medium 1, after being completed a little by S polarization hologram 15, and after converging so that it may once become a minor diameter from the interface of the hologram layer 3 and protective layer 4 which are the location same about the thickness direction as the reference beam for record most in the location of a near side, it passes the hologram layer 3, emitting. This light turns into the reference beam 61 for playback.

[0052] Among the flux of lights from S polarization hologram 15, the polarization direction rotates a part for -45 degrees of right flanks of an optical axis by rotatory-polarization plate 14R of 2 division rotatory-polarization plate 14, and it becomes the flux of light of A polarization. This flux of light is described as reference beam 61R. Moreover, among the flux of lights from S polarization hologram 15, the polarization direction rotates a part for +45 degrees of left flanks of an optical axis by rotatory-polarization plate 14L of 2 division rotatory-polarization plate 14, and it becomes the flux of light of B polarization. This flux of light is described as reference beam 61L. With the gestalt of this operation, by reference beams 61R and 61L, a-like primary playback light is generated from the hologram layer 3, and this-like primary playback light is irradiated by the hologram layer 3 by being reflected by the reflective film 5. With the gestalt of this operation, by making this-like primary playback light into a-like secondary reference beam, a-like secondary playback light occurs from the hologram layer 3, and this-like secondary playback light is used in order to reproduce information.

[0053] Drawing 14 shows signs that a-like primary playback light is generated by reference beam 61R. As shown in this drawing, reference beam 61R is a light converged so that it may become a minor diameter most in the location same about information light ON-R and the thickness direction of [at the time of the record shown in drawing 10]. Therefore, 1st order playback light 62R corresponding to reference beam OFF-L at the time of the record shown in drawing 10 is generated from the hologram layer 3 by this reference beam 61R. In addition, to information light ON-R at the time of record having been the light spatially modulated by the space optical modulator 16, although reference beam 61R at the time of playback is a uniform light, 1st order playback light 62R is generated among reference beam 61R at the time of playback by optical operation by only the part corresponding to information light ON-R at the time of record.

[0054] Drawing 15 shows signs that a-like secondary playback light is generated by making 1st order playback light 62R into a-like secondary reference beam. As shown in this drawing, it goes on in the direction of the reflective film 5 so that it may become a minor diameter most on the interface of the hologram layer 3 and a protective layer 4 and may converge, and it is reflected by the reflective film 5, and 1st order playback light 62R is irradiated by the hologram layer 3 as 2nd order reference beam 63R. This 2nd order reference beam 63R is a light which it is completed so that it may become a minor diameter most in the same location as reference beam OFF-R at the time of the record shown in drawing 11 , and goes to an opposite direction. Therefore, 2nd order playback light 64R corresponding to information light ON-L at the time of the record shown in drawing 11 is generated from the hologram layer 3 by this 2nd order reference beam 63R. In addition, 2nd order playback light 64R is generated among 2nd order reference beam 63R by optical operation also in

this case by only the part corresponding to reference beam OFF-R at the time of record.
[0055] After converging a little with an objective lens 12, 2nd order playback light 64R passes rotatory-polarization plate 14L of 2 division rotatory-polarization plate 14, and becomes the flux of light of P polarization, and it carries out incidence to a polarization beam splitter 17, it passing S polarization hologram 15 and the space optical modulator 16, without being influenced at all, they carrying out incidence to P polarization hologram 28, and being used as the parallel flux of light, and it penetrates this polarization beam splitter 17, and it carries out incidence to the CCD array 18.
[0056] Drawing 16 shows signs that a-like primary playback light is generated by reference beam 61L. As shown in this drawing, reference beam 61L is a light converged so that it may become a minor diameter most in the location same about information light ON-L and the thickness direction of [at the time of the record shown in drawing 11]. Therefore, 1st order playback light 62L corresponding to reference beam OFF-R at the time of the record shown in drawing 11 is generated from the hologram layer 3 by this reference beam 61L. In addition, to information light ON-L at the time of record having been the light spatially modulated by the space optical modulator 16, although reference beam 61L at the time of playback is a uniform light, 1st order playback light 62L is generated among reference beam 61L at the time of playback by optical operation by only the part corresponding to information light ON-L at the time of record.
[0057] Drawing 17 shows signs that a-like secondary playback light is generated by making 1st order playback light 62L into a-like secondary reference beam. As shown in this drawing, it goes on in the direction of the reflective film 5 so that it may become a minor diameter most on the interface of the hologram layer 3 and a protective layer 4 and may converge, and it is reflected by the reflective film 5, and 1st order playback light 62L is irradiated by the hologram layer 3 as 2nd order reference beam 63L. This 2nd order reference beam 63R is a light which it is completed so that it may become a minor diameter most in the same location as reference beam OFF-L at the time of the record shown in drawing 10 , and goes to an opposite direction. Therefore, 2nd order playback light 64L corresponding to information light ON-R at the time of the record shown in drawing 10 is generated from the hologram layer 3 by this 2nd order reference beam 63L. In addition, 2nd order playback light 64L is generated among 2nd order reference beam 63L by optical operation also in this case by only the part corresponding to reference beam OFF-L at the time of record.
[0058] After converging a little with an objective lens 12, 2nd order playback light 64L passes rotatory-polarization plate 14R of 2 division rotatory-polarization plate 14, and becomes the flux of light of P polarization, and it carries out incidence to a polarization beam splitter 17, it passing S polarization hologram 15 and the space optical modulator 16, without being influenced at all, it carrying out incidence to P polarization hologram 28, and being used as the parallel flux of light, and it penetrates this polarization beam splitter 17, and it carries out incidence to the CCD array 18.
[0059] Thus, the-like secondary playback light 64R and 64L carries out incidence to the CCD array 18, on the CCD array 18, in the space optical modulator 16, only the part corresponding to the pixel which was ON is brightly irradiated at the time of record, the two-dimensional pattern is detected by the CCD array 18, and informational playback is performed. In addition, reference beams 61L and 61R are doubled, it expresses the reference beam 61 for playback, the-like secondary playback light 64R and 64L is doubled, and it expresses with drawing 13 the playback light 64.
[0060] In addition, although it is reflected by the reflective film 5 of the optical information record medium 1 at the time of playback and the reference beam 61 for playback returns to it at a pickup 11 side, since the return light 64 of most of this return light will be in a defocusing condition as [showed / in drawing 14 and drawing 16], it does not affect detection of playback light. Moreover, the return light 65 of the some for the center section of the return light of the reference beam 61 for playback is condensed by the core of the space optical modulator 16 with an objective lens 12, as shown in drawing 18 . This return light 65 is considered as P polarization with 2 division rotatory-polarization plate 14. Then, in the space optical modulator 16, if only several pixels of a core are turned OFF, the return light 65 is changed into S polarization and it is made to be reflected by the polarization beam splitter 17, the SN ratio of the information detected by the CCD array 18 can be raised further. Moreover, indefinite light which passes a part for the center section of 2 division rotatory-polarization plate 14, and returns to the space optical modulator 16 by turning OFF only several pixels of the core in the space optical modulator 16 can also be separated from the playback

light which carries out incidence to the CCD array 18, as it is reflected by the polarization beam splitter 17.
[0061] By the way, when detecting the two-dimensional pattern of playback light, it is necessary to position playback light and the CCD array 18 to accuracy, or to recognize the criteria location in the pattern of playback light from the detection data of the CCD array 18 by the CCD array 18. The latter is adopted with the gestalt of this operation. Here, with reference to drawing 19 and drawing 20 , how to recognize the criteria location in the pattern of playback light from the detection data of the CCD array 18 is explained. As shown in drawing 19 (a), the aperture in pickup 11 is divided into two fields 71L and 71R symmetrical as a core in an optical axis with 2 division rotatory-polarization plate 14. Furthermore, as shown in drawing 19 (b), aperture is divided into two or more pixels 72 by the space optical modulator 16. This pixel 72 serves as a smallest unit of two-dimensional pattern data. With the gestalt of this operation, 1-bit digital data "0" or "1" is expressed by 2 pixels, one side of the 2 pixels corresponding to 1-bit information is turned on, and another side is made off. In when [both / ON or when it is both OFF], 2 pixels becomes error data. Thus, expressing 1-bit digital data by 2 pixels has the merit of being able to raise the detection precision of data by differential detection. Drawing 20 (a) expresses the 2-pixel group 73 corresponding to 1-bit digital data. The field where this group 73 exists is hereafter called data area. He is trying to include the criteria positional information which shows the criteria location in the pattern of playback light in information light with the gestalt of this operation using 2 pixels becoming error data in when [both / ON or when it is both OFF]. That is, as shown in drawing 20 (b), error data are intentionally arranged by the predetermined pattern to the field 74 of a cross which consists of a part with an parallel to the parting line of 2 division rotatory-polarization plate 14 width of face of 2 pixels, and a part with a vertical to a parting line width of face of 2 pixels. The pattern of these error data is hereafter called pixel pattern for tracking. This pixel pattern for tracking serves as criteria positional information. In addition, in drawing 20 (b), a sign 75 expresses the pixel of ON and the sign 76 expresses the pixel of OFF. Moreover, as mentioned above, the 4-pixel field 77 for a core is always turned OFF, in order to separate the return light 65 of the reference beam for playback.
[0062] If the pixel pattern for tracking and the pattern corresponding to the data to record are set, it will become a two-dimensional pattern as shown in drawing 21 (a). With the gestalt of this operation, while turning OFF the upper half in drawing among fields other than a data area and turning ON a lower half further, if fields other than a data area and a reverse condition, i.e., fields other than a data area, are off and fields other than ON and a data area are ON, suppose that it is off about the pixel which touches fields other than a data area in a data area. This becomes possible [detecting the boundary part of a data area more clearly] from the detection data of the CCD array 18.
[0063] The interference pattern of the information light and the reference beam for record by which the space modulation was carried out according to the two-dimensional pattern as shown in drawing 21 (a) at the time of record is recorded on the hologram layer 3. As the pattern of the playback light obtained at the time of playback was shown in drawing 21 (b), contrast falls compared with the time of record, and the SN ratio is getting worse. Although the pattern of playback light as shown in drawing 21 (b) is detected and data are distinguished by the CCD array 18 at the time of playback, in that case, the pixel pattern for tracking is recognized and data are distinguished by making the location into a criteria location.
[0064] Drawing 22 (a) expresses notionally the content of the data distinguished from the pattern of playback light. A-1-1 in drawing etc. -- the data whose field which attached the sign is 1 bit, respectively are expressed. With the gestalt of this operation, it divides into the four fields 78A, 78B, 78C, and 78D by dividing a data area in the field 74 of a cross in which the pixel pattern for tracking was recorded. And the diagonal fields 78A and 78C are doubled, a rectangular field is formed, the diagonal fields 78B and 78D are doubled similarly, and he forms a rectangular field, and is trying to form an ECC table by arranging the field of two rectangles up and down, as shown in drawing 22 (b). An ECC table is a table of the data which added and formed error correction codes (ECC), such as the CRC (cyclic redundancy check) code, in the data which should be recorded. In addition, drawing 22 (b) can show an example of the ECC table of a n line m train, and can also design other arrays freely. Moreover, the part which the data array shown in drawing 22 (a) uses the part of the

ECC tables shown in drawing 22 (b), and is not used for the data array shown in drawing 22 (a) among the ECC tables shown in drawing 22 (b) is not concerned with the content of data, but let it be a fixed value. At the time of record, decompose into four fields 78A, 78B, 78C, and 78D, and an ECC table as shown in drawing 22 (b) is recorded on the optical information record medium 1, as shown in drawing 22 (a). At the time of playback, the data of an array as shown in drawing 22 (a) are detected, an ECC table as rearranged this and shown in drawing 22 (b) is reproduced, an error correction is performed based on this ECC table, and data are reproduced.

[0065] Recognition of the criteria location (pixel pattern for tracking) in the pattern of the above playback light and an error correction are performed by the digital disposal circuit 89 in drawing 2 .

[0066] As explained above, according to the optical information record regenerative apparatus 10 and the optical information record medium 1 concerning the gestalt of this operation The exposure of the reference beam for record to the optical information record medium 1 at the time of record, and information light, Since it was made to perform exposure of the reference beam for record to the optical information record medium 1 at the time of playback, and detection of playback light on the same shaft from the same field side to the optical information record medium 1 altogether Compared with the conventional holographic recording method, the optical system for record or playback can be constituted small, and the problem of the stray light like [in the case of being the conventional holographic recording method] does not arise. Moreover, according to the gestalt of this operation, the optical system for record and playback can consist of forms of the same pickup 11 as the usual optical disk unit.

[0067] Moreover, according to the optical information record regenerative apparatus 10 and the optical information record medium 1 concerning the gestalt of this operation Since the information for performing a focus servo and a tracking servo is recorded on the optical information record medium 1 and it enabled it to perform a focus servo and a tracking servo using this information While being able to position light for record or playback with a sufficient precision, consequently a remover kinky thread tee's being good and random access's becoming easy, storage capacity and a transfer rate can be enlarged.

[0068] Moreover, according to the optical information record regenerative apparatus 10 concerning the gestalt of this operation, at the time of record, in the field on the left-hand side of the optical axis of the reference beam for record, and information light, and a right-hand side field, since the polarization direction of the light made to interfere is made to intersect perpendicularly, generating of an excessive interference fringe can be prevented and lowering of an SN ratio can be prevented.

[0069] Moreover, since it was made to include the criteria positional information which shows the criteria location in the pattern of playback light in information light according to the optical information record regenerative apparatus 10 concerning the gestalt of this operation, recognition of the pattern of playback light becomes easy.

[0070] Moreover, according to the optical information record regenerative apparatus 10 concerning the gestalt of this operation, since 2 division rotatory-polarization plate 14 and the space optical modulator 16 were constituted using liquid crystal, it is also possible to also make it not operate substantially 2 division rotatory-polarization plate 14 and the space optical modulator 16 and to constitute so that compatibility with the conventional optical disk unit may be given possible therefore.

[0071] Drawing 23 is the explanatory view showing the configuration of the pickup in the optical information record regenerative apparatus concerning the gestalt of operation of the 2nd of this invention. The pickup 91 in the gestalt of this operation arranges the CCD array 93 in the side of this beam splitter 92 while inserting a beam splitter 92 between a collimator lens 19 and a polarization beam splitter 17 to the pickup 11 in the gestalt of the 1st operation. A beam splitter 92 is an optical element which penetrates the one half of the quantity of light of incident light, and reflects one half. Each output signal of the CCD arrays 18 and 93 is inputted into the digital disposal circuit 83 in drawing 2 .

[0072] Next, an operation of the optical information record regenerative apparatus concerning the gestalt of this operation is explained. At the time of a servo and record, by a collimator lens's 19 considering as the parallel flux of light, and carrying out incidence to a beam splitter 92, the one half of the quantity of light penetrates a beam splitter 92, carries out incidence of the laser beam of S

polarization by which outgoing radiation was carried out from the laser coupler 20 to a polarization beam splitter 17, and it is reflected by the polarization beam splitter 17. The operation of others at the time of a servo and record is the same as that of the gestalt of the 1st operation.
[0073] Also at the time of playback, the laser beam of S polarization by which outgoing radiation was similarly carried out from the laser coupler 20 is made the parallel flux of light by the collimator lens 19, incidence is carried out to a beam splitter 92, the one half of the quantity of light penetrates a beam splitter 92, and carries out incidence to a polarization beam splitter 17, and it is reflected by the polarization beam splitter 17. The condition of the space optical modulator 16 at the time of playback and 2 division rotatory-polarization plate 14 is the same as the gestalt of the 1st operation. Therefore, like the gestalt of the 1st operation, as shown in drawing 1414 thru/or drawing 17 The 1st order playback light [layer / 3 / hologram] 62R and 62L is generated by reference beams 61R and 61L. These-like primary playback light 62R and 62L The hologram layer 3 irradiates as-like secondary reference beams 63R and 63L by being reflected by the reflective film 5. The 2nd order playback light [layer / 3 / hologram] 64R and 64L occurs. These-like secondary playback light 64R and 64L After converging a little with an objective lens 12, pass 2 division rotatory-polarization plate 14, and it becomes the flux of light of P polarization. S polarization hologram 15 and the space optical modulator 16 are passed without being influenced at all, incidence is carried out to P polarization hologram 28, it considers as the parallel flux of light, and incidence is carried out to a polarization beam splitter 17, a polarization beam splitter 17 is penetrated and incidence is carried out to the CCD array 18. In addition, the-like secondary playback light 64R and 64L is expressed in drawing 23 R> 3 as the-like secondary [in all] playback light 64. The operation so far is the same as that of the gestalt of the 1st operation, and abbreviation.
[0074] With the gestalt of this operation, besides the-like secondary playback light 64R and 64L which carries out incidence to the CCD array 18 as mentioned above, the-like primary playback light 62R and 62L is also used, and information is reproduced. That is, in the gestalt of this operation, after being reflected by the reflective film 5 and making-like primary playback light 62R and 62L into the parallel flux of light with an objective lens 12, they passes the rotatory-polarization plates 14R and 14L of 2 division rotatory-polarization plate 14, and serves as the flux of light of S polarization. The space optical modulator 16 and P polarization hologram 28 are passed without being influenced at all, after S polarization hologram 15 converged these 1st order-playback light 62R and 62L a little, incidence is carried out to a polarization beam splitter 17, it is reflected by the polarization beam splitter 17, incidence is carried out to a beam splitter 92, the one half of that quantity of light is reflected by the beam splitter 92, and incidence is carried out to the CCD array 93. In addition, the-like primary playback light 62R and 62L is expressed in drawing 23 as the-like primary [in all] playback light 62.
[0075] Here, the relation between the primary-like playback light 62 which carries out incidence to the CCD array 93, and the-like secondary playback light 64 which carries out incidence to the CCD array 18 is explained. Since the-like primary playback light 62 is the flux of light reproduced by the reference beam 61 corresponding to information light ON-R at the time of the record shown in drawing 10 and drawing 11 , and ON-L, it is the flux of light which has the same pattern as reference beam OFF-R at the time of record, and OFF-L. On the other hand, since the-like secondary playback light 64 is the flux of light reproduced by the-like primary playback light 62 corresponding to reference beam OFF-R at the time of record, and OFF-L, it is the flux of light which has the same pattern as information light ON-R at the time of record, and ON-L. Here, the pattern of reference beam OFF-R and OFF-L and the pattern of information light ON-R and ON-L have complementary relation so that clearly from the explanation in the gestalt of the 1st operation. Therefore, the-like primary playback light 62 and the-like secondary playback light 64 are the flux of lights in which the relation of light and darkness has the complementary pattern of reverse mutually. The 1st order playback light [this] 62 and the-like secondary playback light 64 mean that each is supporting the information recorded on the hologram layer 3.
[0076] With the gestalt of this operation, the information recorded on the hologram layer 3 is reproduced by the so-called differential detection by searching for the difference of the pattern of the-like primary playback light 62, and the pattern of the-like secondary playback light 64. With in addition, the primary-like playback light 62 which carries out incidence to the CCD array 93 and the-

like secondary playback light 64 which carries out incidence to the CCD array 18 Since the quantity of light differs from the magnitude of a pattern, actually A lens etc. is used. Double the magnitude of the pattern of the-like primary playback light 62, and the pattern of the-like secondary playback light 64 optically, or While doubling magnitude of the pattern detected by the CCD arrays 93 and 19 by signal processing to the output signal of the CCD arrays 93 and 18 The level of the output signal of the CCD arrays 93 and 18 is doubled, the amended signal corresponding to the output signal of the CCD array 93 and the amended signal corresponding to the output signal of the CCD array 18 are generated, the difference of both this signal is calculated, and the information recorded on the hologram layer 3 is reproduced. In addition, signal processing to the output signal of the CCD arrays 93 and 18 is performed by the digital disposal circuit 89 in drawing 2 .

[0077] According to the optical information record regenerative apparatus concerning the gestalt of this operation, the two flux of lights which have the complementary pattern obtained from the hologram layer 3 by irradiating the reference beam 61 for playback at the hologram layer 3 are detected. By differential detection Since the information recorded on the hologram layer 3 in quest of the difference of both patterns was reproduced, the direct-current noise component on which each pattern in the two flux of lights is overlapped can be canceled, and an SN ratio can be raised. The configuration of others in the gestalt of this operation, an operation, and effectiveness are the same as the gestalt of the 1st operation.

[0078] Next, the optical information record regenerative apparatus concerning the gestalt of operation of the 3rd of this invention is explained. The configuration of the optical whole information record regenerative apparatus concerning the gestalt of this operation is the same as that of the abbreviation for the configuration of the optical information record regenerative apparatus 10 concerning the gestalt of the 1st operation shown in drawing 2 . However, the configuration of pickup differs from the gestalt of the 1st operation.

[0079] In addition, the configuration of the optical information record medium 1 used with the optical information record regenerative apparatus concerning the gestalt of this operation As were shown in drawing 25 , and what was formed in this sequence may be used and the hologram layer 3, the reflective film 5, and a protective layer 4 were shown in the whole surface of the transparence substrate 2 as well as the gestalt of the 1st operation at drawing 26 What made the hologram layer 3 thin and formed the hologram layer 3, the transparence medium layer 8, the reflective film 5, and a protective layer 4 in the whole surface of the transparence substrate 2 in this sequence rather than the example shown in drawing 25 may be used. The transparence medium layer 8 is formed with glass etc. Embossing pits, such as the same groove for tracking servos as the conventional optical disk and an address pit used in order to know the location on the WOPURU pit in a sample DOSABO method and the optical information record medium 1, are formed in the reflector formed with the reflective film 5. Like the gestalt of the 1st operation, when using a sample DOSABO method, as shown in the optical information record medium 1 at drawing 1 , the address servo area 6 is formed at intervals of a predetermined include angle, and a data area 7 is formed between the adjacent address servo area 6.

[0080] Drawing 24 is the explanatory view showing the configuration of the pickup in the gestalt of this operation. When the optical information record medium 1 is fixed to a spindle 81, this pickup 111 The objective lens 12 which counters the transparence substrate 2 side of the optical information record medium 1, and this objective lens 12 The thickness direction and the radially movable actuator 13 of the optical information record medium 1, The space optical modulator 116, the beam splitter 117, and the CCD array 118 which were arranged in the opposite hand of the optical information record medium 1 in an objective lens 12 sequentially from the objective lens 12 side, It has the collimator lens 19 arranged between the laser coupler 20 arranged in the side of a beam splitter 117, and this laser coupler 20 and beam splitter 117. The space optical modulator 116 in the gestalt of this operation has the pixel of a large number arranged in the shape of a grid, and can modulate light now spatially with optical reinforcement by choosing the transparency condition and cut off state of light for every pixel. As a space optical modulator 116, a liquid crystal display component can be used, for example. A beam splitter 117 is an optical element which penetrates the one half of the quantity of light of the flux of light which carried out incidence, and reflects one half.

[0081] In addition, the output signal of the CCD array 118 is inputted into the digital disposal circuit

89 in drawing 2 . Moreover, the space optical modulator 116 is controlled by the controller 90 in drawing 2 .

[0082] Next, the case of a sample DOSABO method is taken for an example, at the time of a servo, at the time of record, it divides at the time of playback and an operation of the optical information record regenerative apparatus concerning the gestalt of this operation and an optical information record medium is explained in order. In addition, at the time of a servo, at the time of record, it is controlled to maintain a regular rotational frequency also at the time of any at the time of playback, and the optical information record medium 1 rotates it with a spindle motor 82.

[0083] First, the operation at the time of a servo is explained. At the time of a servo, it changes all the pixels of the space optical modulator 116 into a transparency condition. The output of the outgoing radiation light of the laser coupler 20 is set as the low-power output for playback. In addition, a controller 90 is considered as the above-mentioned setting out, while the timing to which the outgoing radiation light of an objective lens 12 passes through the address servo area 6 is predicted based on the basic clock reproduced from the regenerative signal RF and the outgoing radiation light of an objective lens 12 passes through the address servo area 6.

[0084] The coherent laser beam by which outgoing radiation was carried out from the laser coupler 20 is made the parallel flux of light by the collimator lens 19, and carries out incidence to a beam splitter 117, and the one half of the quantity of light is reflected by this beam splitter 117. The space optical modulator 116 is passed and it is condensed with an objective lens 12, and the flux of light reflected by the beam splitter 117 is irradiated by the information record medium 1 so that it may become a minor diameter most on the interface (reflective film 5) of the hologram layer 3 in the optical information record medium 1, and a protective layer 4 and may converge. It is reflected by the reflective film 5 of the information record medium 1, and in that case, the embossing pit in the address servo area 6 becomes irregular, and this light returns to an objective lens 12 side. This return light is made into the parallel flux of light with an objective lens 12, the space optical modulator 116 is passed, incidence is carried out to a beam splitter 117, and the one half of the quantity of light is reflected by this beam splitter 117. Incidence of the flux of light reflected by the beam splitter 117 is carried out to the laser coupler 20, and it is detected by the photodetectors 25 and 26 shown in drawing 3 and drawing 4 . And while focal error signal FE, the tracking error signal TE, and a regenerative signal RF are generated by the detector 85 shown in drawing 5 and a focus servo and a tracking servo are performed based on these signals based on the output of these photodetectors 25 and 26, playback of a basic clock and distinction of the address are performed.

[0085] In addition, in setting out at the time of the above-mentioned servo, the configuration of pickup 11 becomes being the same as that of the configuration of pickup of for [to the usual optical disks, such as CD (compact disc), DVD (digital videodisc), and HS (hyper-storage disk), / record and for playback]. Therefore, it is also possible to constitute from an optical information record regenerative apparatus in the gestalt of this operation so that compatibility with the usual optical disk unit may be given.

[0086] Next, the operation at the time of record is explained. The explanatory view showing the condition of the pickup [drawing / 2727] 111 at the time of record, the explanatory view in which drawing 28 shows the condition of the space optical modulator 116 at the time of record, and drawing 29 are the explanatory views showing the condition of the light in the optical information record medium at the time of record. As shown in drawing 28 , at the time of record, a transparency condition and a cut off state are chosen for every pixel according to the information which records the space optical modulator 116 by field 116R of a right half, and all pixels are made into a transparency condition by field 116L of a left half at it. Moreover, the output of the outgoing radiation light of the laser coupler 20 is made into the high power for record in pulse. In addition, a controller 90 is considered as the above-mentioned setting out, while the timing to which the outgoing radiation light of an objective lens 12 passes a data area 7 is predicted based on the basic clock reproduced from the regenerative signal RF and the outgoing radiation light of an objective lens 12 passes a data area 7. While the outgoing radiation light of an objective lens 12 passes a data area 7, a focus servo and a tracking servo are not performed, but the objective lens 12 is being fixed.

[0087] The laser beam by which outgoing radiation was carried out from the laser coupler 20 is made into the parallel flux of light, and carries out incidence to a beam splitter 117, the one half of

the quantity of light is reflected by the collimator lens 19 by this beam splitter 117, and incidence of it is carried out to the space optical modulator 116 by it. Consequently, the light which passed field 116R in the right half of the space optical modulator 116 turns into light modulated according to the information to record. Let this light be the information light 121 with the gestalt of this operation. On the other hand, the light which passed field 116L in the left half of the space optical modulator 116 turns into light which is not modulated. Let this light be the reference beam 122 for record with the gestalt of this operation. As shown in drawing 2929 , being condensed with an objective lens 12 and converging, it converges so that the hologram layer 3 may be passed and it may become a minor diameter most on the reflective film 5, it is reflected by the reflective film 5, and both the information light 121 and the reference beam 122 for record pass the hologram layer 3 again, being spread. In field 123R which the information light 121 converged among the hologram layers 3 passes, the information light 121 to converge and the reference beam 122 for record which was reflected by the reflective film 5 and to diffuse interfere, and the interference pattern is recorded in volume. Moreover, in field 123L which the reference beam 122 for record converged among the hologram layers 3 passes, the reference beam 121 for record to converge and the information light 121 which was reflected by the reflective film 5 and to diffuse interfere, and the interference pattern is recorded in volume. Also in which fields 123R and 123L, since the travelling direction of the information light 121 and the reference beam 122 for record is opposite, the hologram of a reflective mold (Lippmann mold) is formed in the hologram layer 3. in addition, it was shown in drawing 29 -- as -- the thickness d1 as the thickness between the transparence substrate 2 and the reflective film 5 with the same thickness of the hologram layer 3 carrying out -- thickness d2 thinner than it .

[0088] Next, the operation at the time of playback is explained. The explanatory view showing the condition of the pickup [drawing / 3030] 111 at the time of record, the explanatory view in which drawing 31 shows the condition of the space optical modulator 116 at the time of playback, and drawing 32 are the explanatory views showing the condition of the light in the optical information record medium at the time of playback. As shown in drawing 31 , at the time of playback, all pixels are made into a cut off state in field 116R of a right half, and, as for the space optical modulator 116, all pixels are made into a transparency condition by field 116L of a left half. Moreover, the output of the outgoing radiation light of the laser coupler 20 is made into the low-power output for playback. In addition, a controller 90 is considered as the above-mentioned setting out, while the timing to which the outgoing radiation light of an objective lens 12 passes a data area 7 is predicted based on the basic clock reproduced from the regenerative signal RF and the outgoing radiation light of an objective lens 12 passes a data area 7. While the outgoing radiation light of an objective lens 12 passes a data area 7, a focus servo and a tracking servo are not performed, but the objective lens 12 is being fixed.

[0089] The laser beam by which outgoing radiation was carried out from the laser coupler 20 is made into the parallel flux of light, and carries out incidence to a beam splitter 117, the one half of the quantity of light is reflected by the collimator lens 19 by this beam splitter 117, and incidence of it is carried out to the space optical modulator 116 by it. The light which carried out incidence to field 116R in the right half of the space optical modulator 116 among this light is intercepted, and only the light which carried out incidence to field 116L of a left half passes it. Let light which passed field 116L in the left half of the space optical modulator 116 be the reference beam 125 for playback with the gestalt of this operation. As shown in drawing 32 , being condensed with an objective lens 12 and converging, it converges so that the hologram layer 3 may be passed and it may become a minor diameter most on the reflective film 5, it is reflected by the reflective film 5, and the reference beam 125 for playback passes the hologram layer 3 again, being spread. In field 123L which the reference beam 125 for playback converged among the hologram layers 3 passes, the playback light 126 corresponding to the information light 121 at the time of record is generated by irradiating the reference beam 125 for playback. This playback light 126 advances to an objective lens 12 side, being spread. Moreover, in field 123R which the reference beam 125 for playback which was reflected by the reflective film 5 among the hologram layers 3, and to diffuse passes, the playback light 127 corresponding to the information light 121 at the time of record is generated by irradiating the reference beam 125 for playback. This playback light 127 advances to the reflective film 5 side, converging, and it advances to an objective lens 12 side, being reflected by the reflective film 5 and

spread, while converging so that it may become a minor diameter most on the reflective film 5. The playback light 126 and the playback light 127 are the light which supported the same information. With an objective lens 12, such playback light 126,127 is made into the parallel flux of light, they passes field 116L in the left half of the space optical modulator 116, and it carries out incidence to a beam splitter 117, and the one half of the quantity of light penetrates them by this beam splitter 117, and they carries out incidence to the CCD array 118. And informational playback is performed by the CCD array 118 by detecting the two-dimensional pattern of the playback light 126,127. In addition, with the gestalt of this operation, as shown in drawing 30 R> 0, the CCD array 118 should just be the magnitude in which the appearance which passed field 116L in the left half of the space optical modulator 116 can detect the semicircle-like flux of light.

[0090] According to the optical information record regenerative apparatus applied to the gestalt of this operation as explained above, compared with the gestalt of the 1st operation, the configuration of pickup 111 becomes easy and reduction of cost is attained. The configuration of others in the gestalt of this operation, an operation, and effectiveness are the same as the gestalt of the 1st operation.

[0091] By the way, as an optical information record medium equipped with the information recording layer on which information is recorded using holography, a thing as shown in drawing 33 may be used. This optical information record medium 201 carries out the laminating of the transparence substrate 202, the hologram layer 203, the reflective film 204, and the transparence substrate 205 in this sequence, and is constituted. The reflective time folded part 206 is formed in the field by the side of the hologram layer 203 of the reflective film 204. This reflective time folded part 206 is a field reflected at an include angle which diffracts incident light and is different from an incident angle.

[0092] Incidence of the incident light 207 to converge is carried out to the optical information record medium 201 shown in drawing 33 from the transparence substrate 202 side. In this case, incident light 207 passes the transparence substrate 202 and the hologram layer 203 in order, and they carry out incidence to the reflective time folded part 206. The reflective time folded part 206 diffracts, it is reflected at a different include angle from an incident angle, and this incident light 207 passes the hologram layer 203 again as the reflected light 208 by it. Therefore, as shown in drawing 33 , the field through which the reflected light 208 passes in the hologram layer 203 becomes larger than the field through which incident light 207 passes.

[0093] Therefore, by recording information on the hologram layer 203 using holography by making the reflected light 208 into information light or the reference beam for record, it becomes possible to enlarge the field where information is recorded on the optical information record medium which does not have the reflective time folded part 206 compared with a case, and it becomes possible to use the hologram layer 203 effectively.

[0094] Drawing 34 thru/or drawing 36 show the example of the formation approach of the reflective time folded part 206, respectively. The example shown in drawing 34 is an example which arranged the square-like groove 211 in the shape of a grid, and formed the reflective time folded part 206 by these grooves 211 and the land 212 by using the perimeter of a groove 211 as a land 212 on the reflective film 204. Thus, by diffraction, if incidence of the incident light 207 to converge as shown in drawing 33 is carried out to the formed reflective time folded part 206, as shown in drawing 34 , the reflected light 208 will be generated so that it may spread on all sides which is the array direction of a groove 211.

[0095] The example shown in drawing 35 is an example which has arranged the circular groove 221 and formed the reflective time folded part 206 in the imagination location and imagination center position of each top-most vertices of a hexagon by these grooves 221 and the land 222 by using the perimeter of a groove 221 as a land 222 on the reflective film 204. Thus, by diffraction, if incidence of the incident light 207 to converge as shown in drawing 33 is carried out to the formed reflective time folded part 206, as shown in drawing 35 R> 5, the reflected light 208 will be generated so that it may spread in the roppo which is the array direction of a groove 221.

[0096] The example shown in drawing 36 is an example which has arranged the rectangle-like groove 231 and formed the reflective time folded part 206 by these grooves 231 and the land 232 by using the perimeter of a groove 231 as a land 232 along the direction 234 of a truck on the reflective

film 204. Thus, if incidence of the incident light 207 to converge as shown in drawing 33 is carried out to the formed reflective time folded part 206, the reflected light 208 will be generated so that it may spread by diffraction in the direction which intersects perpendicularly in the direction 234 of a truck.

[0097] Without forming the reflective time folded part 206 on the reflective film 204, instead, drawing 37 irradiates the laser beam of high power selectively at the part near the reflective film 204 of the hologram layer 203, and shows the optical information record medium 241 in which the reflective time folded part 242 was formed, by changing the refractive index of the part selectively. The pattern of the reflective time folded part 242 in this optical information record medium 241 can be made into the same thing as a pattern as shown in

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[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the explanatory view showing the pickup in the optical information record regenerative apparatus concerning the gestalt of operation of the 1st of this invention, and the configuration of an optical information record medium.
[Drawing 2] It is the block diagram showing the whole optical information record regenerative-apparatus configuration concerning the gestalt of operation of the 1st of this invention.
[Drawing 3] It is the perspective view showing the configuration of the laser coupler in drawing 1 .
[Drawing 4] It is the side elevation of the laser coupler in drawing 1 .
[Drawing 5] It is the block diagram showing the configuration of the detector in drawing 2 .
[Drawing 6] It is the explanatory view showing the condition at the time of the servo of the pickup shown in drawing 1 .
[Drawing 7] It is an explanatory view for explaining the polarization used in the gestalt of operation of the 1st of this invention.
[Drawing 8] It is the explanatory view showing the condition of the light in the pickup of the condition which showed in drawing 6 .
[Drawing 9] It is the explanatory view showing the condition at the time of record of the pickup shown in drawing 1 .
[Drawing 10] It is the explanatory view showing the condition of the light in the pickup of the condition which showed in drawing 9 .
[Drawing 11] It is the explanatory view showing the condition of the light in the pickup of the condition which showed in drawing 9 .
[Drawing 12] It is the explanatory view which expresses notionally the situation of the interference in the hologram layer shown in drawing 10 and drawing 11 .
[Drawing 13] It is the explanatory view showing the condition at the time of playback of the pickup shown in drawing 1 .
[Drawing 14] It is the explanatory view showing the condition of the light in the pickup of the condition which showed in drawing 13 .
[Drawing 15] It is the explanatory view showing the condition of the light in the pickup of the condition which showed in drawing 13 .
[Drawing 16] It is the explanatory view showing the condition of the light in the pickup of the condition which showed in drawing 13 .
[Drawing 17] It is the explanatory view showing the condition of the light in the pickup of the condition which showed in drawing 13 .
[Drawing 18] It is an explanatory view for explaining clearance of the reference beam for playback in the pickup of the condition which showed in drawing 13 .
[Drawing 19] It is an explanatory view for explaining how to recognize the criteria location in the pattern of playback light from the detection data of the CCD array in drawing 1 .
[Drawing 20] It is an explanatory view for explaining how to recognize the criteria location in the pattern of playback light from the detection data of the CCD array in drawing 1 .
[Drawing 21] It is the explanatory view showing the pattern of information light and the pattern of playback light in the pickup shown in drawing 1 .
[Drawing 22] It is the explanatory view showing the content of the data distinguished from the

pattern of the playback light detected by the pickup shown in drawing 1 , and the ECC table corresponding to this data.
[Drawing 23] It is the explanatory view showing the configuration of the pickup in the optical information record regenerative apparatus concerning the gestalt of operation of the 2nd of this invention.
[Drawing 24] It is the explanatory view showing the configuration of the pickup in the optical information record regenerative apparatus concerning the gestalt of operation of the 3rd of this invention.
[Drawing 25] It is the explanatory view showing an example of the configuration of the optical information record medium in the gestalt of operation of the 3rd of this invention.
[Drawing 26] It is the explanatory view showing other examples of the configuration of the optical information record medium in the gestalt of operation of the 3rd of this invention.
[Drawing 27] It is the explanatory view showing the condition at the time of record of the pickup shown in drawing 24 .
[Drawing 28] It is the explanatory view showing the condition of the space optical modulator in the pickup of the condition which showed in drawing 27 .
[Drawing 29] It is the explanatory view showing the condition of the light in the optical information record medium in the condition which showed in drawing 27 .
[Drawing 30] It is the explanatory view showing the condition at the time of playback of the pickup shown in drawing 24 .
[Drawing 31] It is the explanatory view showing the condition of the space optical modulator in the pickup of the condition which showed in drawing 30 .
[Drawing 32] It is the explanatory view showing the condition of the light in the optical information record medium in the condition which showed in drawing 30 .
[Drawing 33] It is the explanatory view showing the example of the optical information record medium which has a reflective time folded part.
[Drawing 34] It is the explanatory view showing the example of the formation approach of the reflective time folded part in drawing 33 .
[Drawing 35] It is the explanatory view showing the example of the formation approach of the reflective time folded part in drawing 33 .
[Drawing 36] It is the explanatory view showing the example of the formation approach of the reflective time folded part in drawing 33 .
[Drawing 37] It is the explanatory view showing the example of the formation approach of the reflective time folded part in drawing 33 .
[Drawing 38] It is the perspective view showing the configuration of the outline of the record reversion system in the conventional digital volume holography.
[Description of Notations]
1 -- light information record medium and 2 -- a transparence substrate, 3 -- hologram layer, 4 -- protective layer, and 5 -- the reflective film, 6 -- address servo area, 7 -- data area, and 10 -- an optical information record regenerative apparatus, 11 -- pickup, 12 -- objective lens, and 14 -- 2 division rotatory-polarization plate, 15 --S polarization hologram, 16 -- space optical modulator, and 17 -- a polarization beam splitter, a 20 -- laser coupler, and 28 --P polarization hologram

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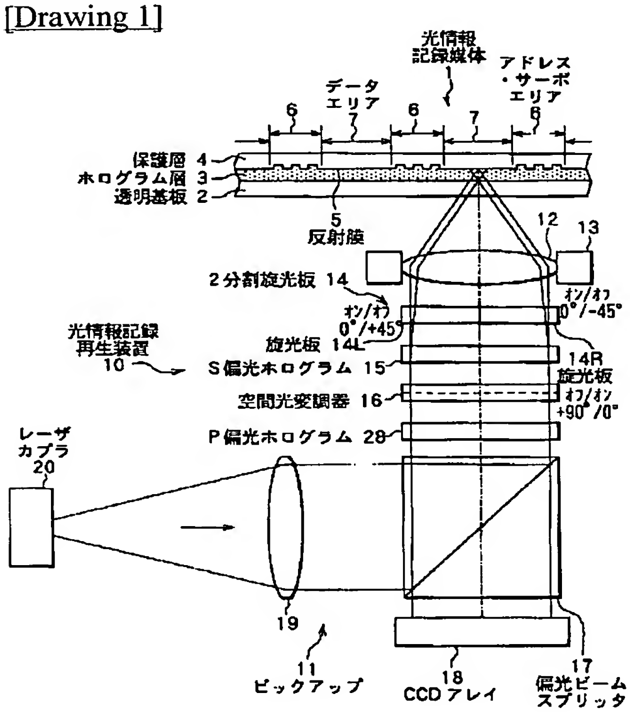
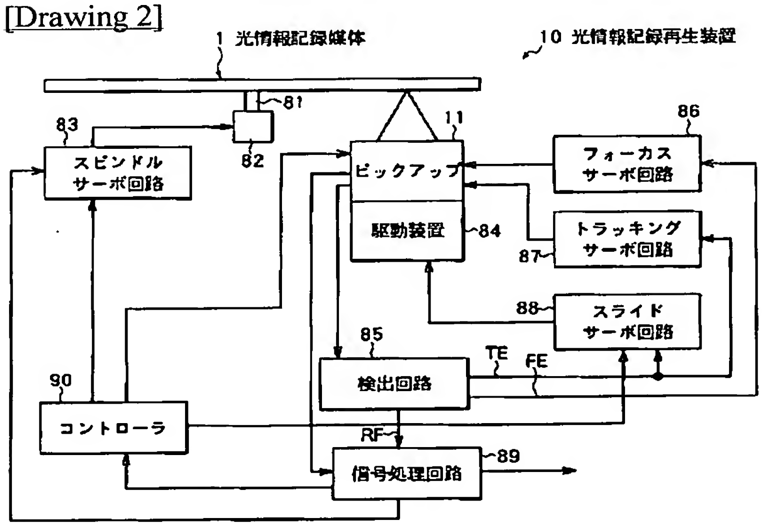
[Translation done.]

DRAWINGS

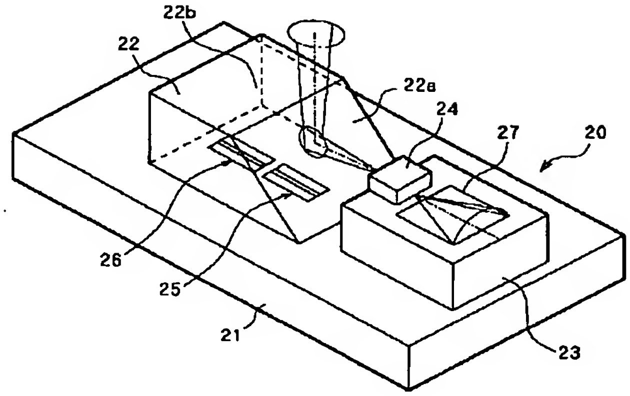
[Drawing 1]



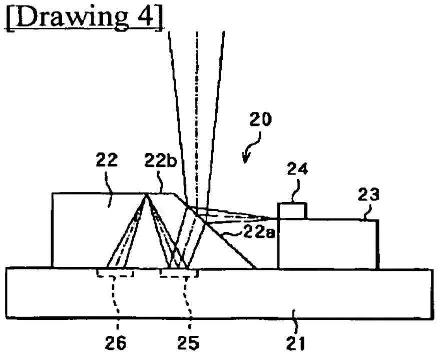
[Drawing 2]



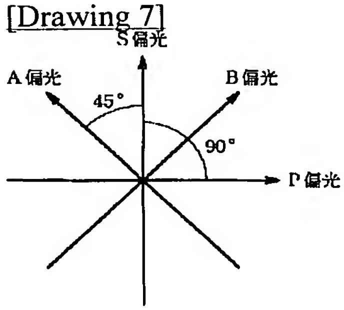
[Drawing 3]



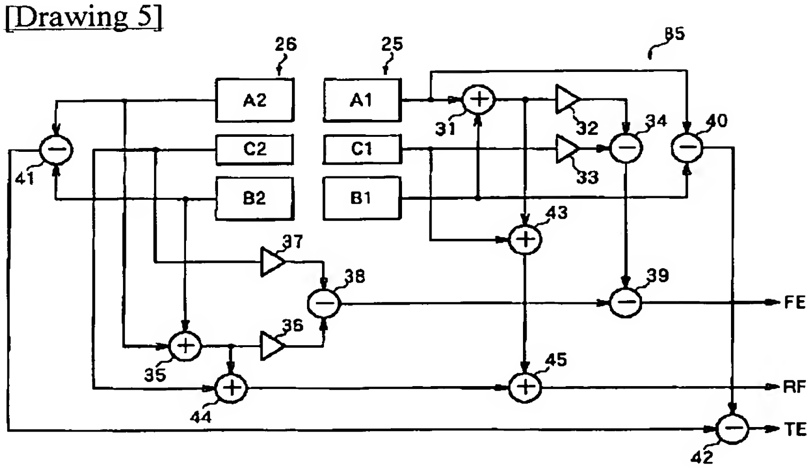
[Drawing 4]



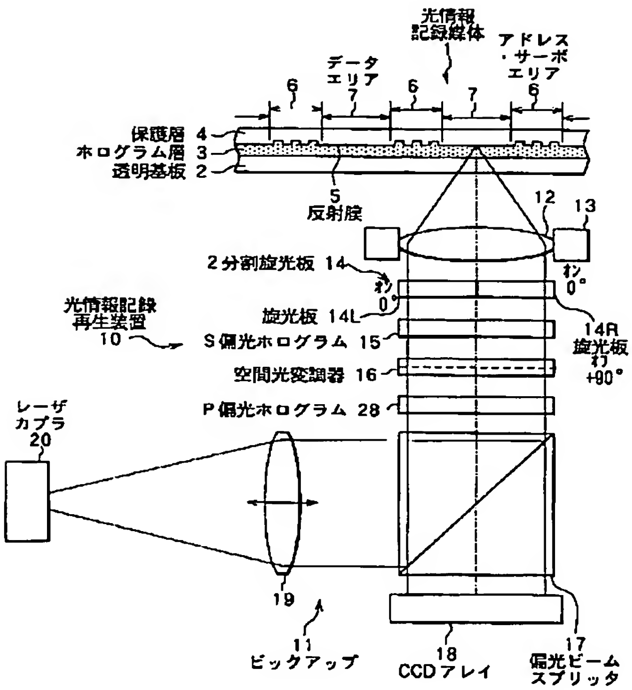
[Drawing 7]



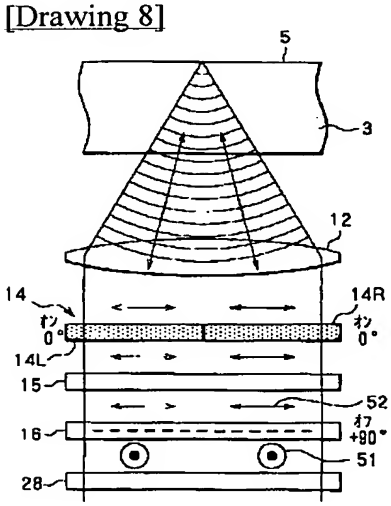
[Drawing 5]



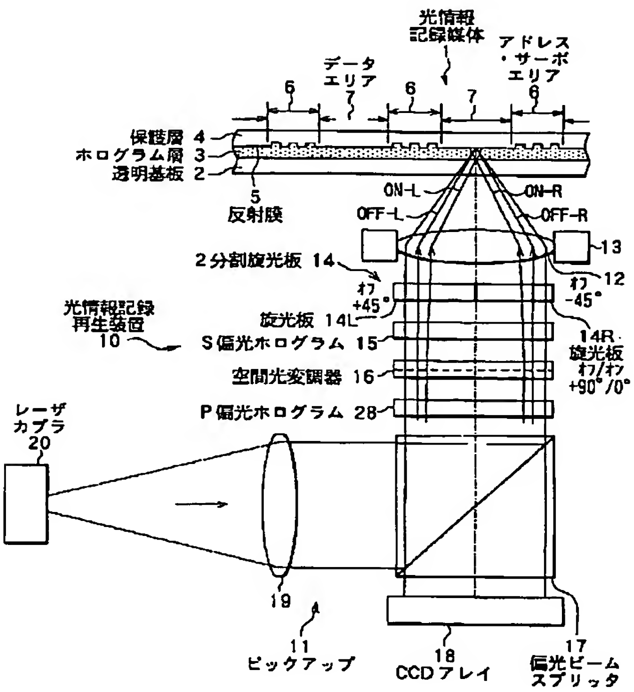
[Drawing 6]



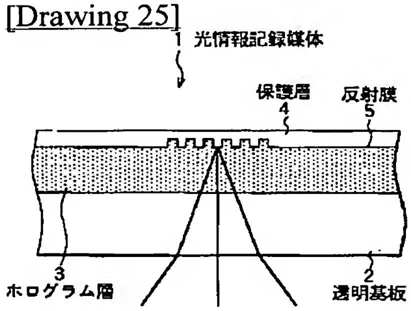
[Drawing 8]



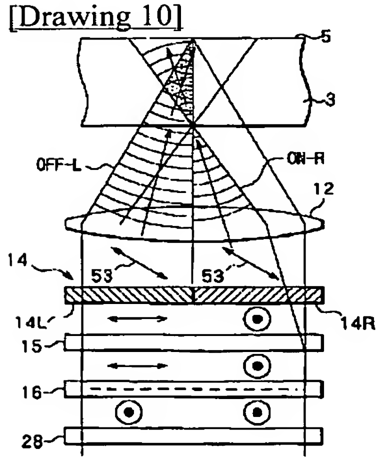
[Drawing 9]



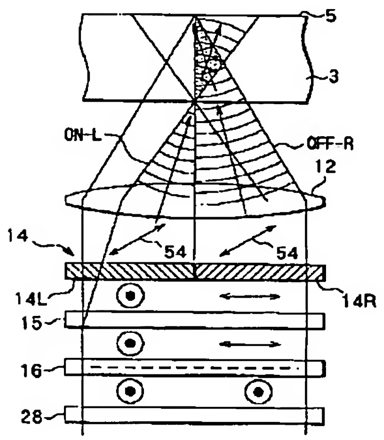
[Drawing 25]



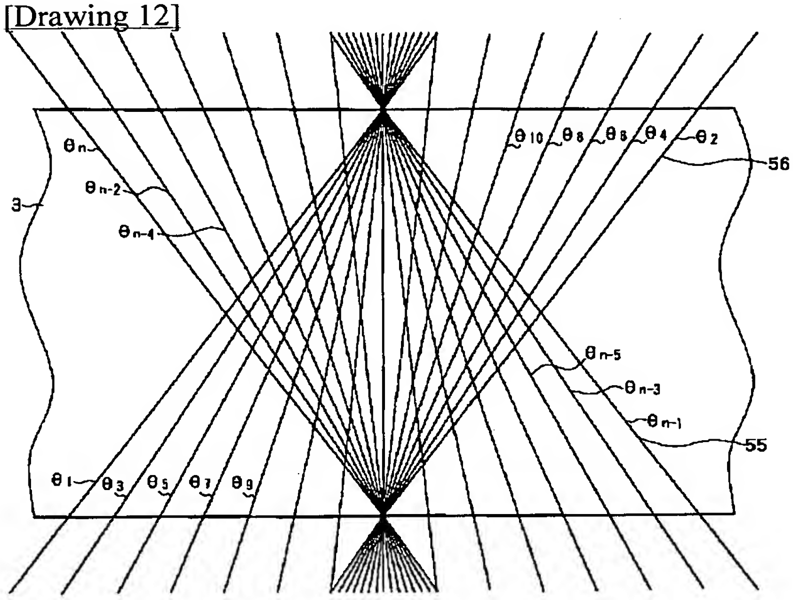
[Drawing 10]



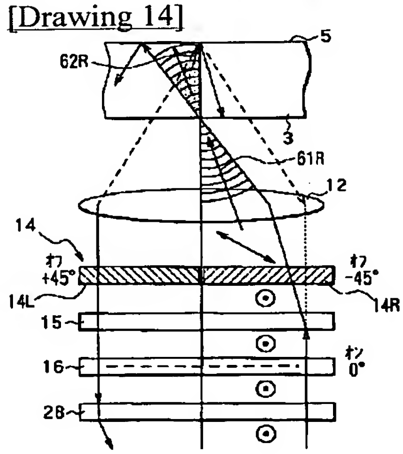
[Drawing 11]



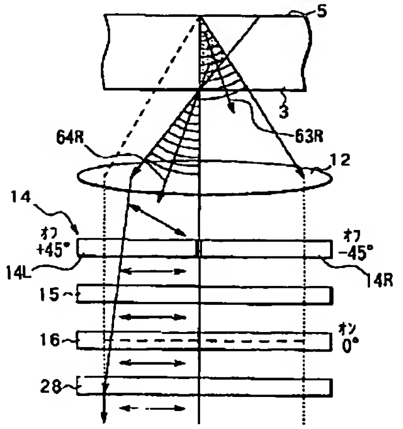
[Drawing 12]



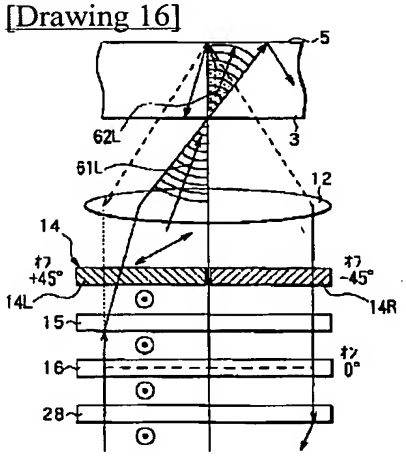
[Drawing 14]



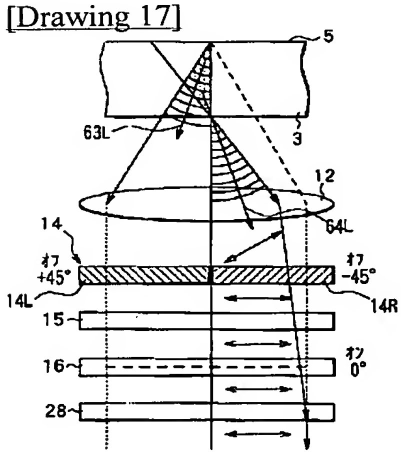
[Drawing 15]



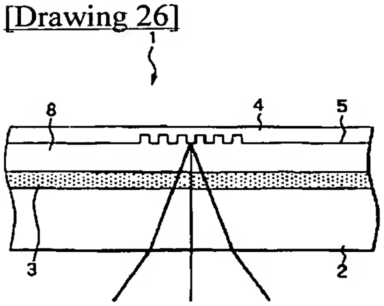
[Drawing 16]



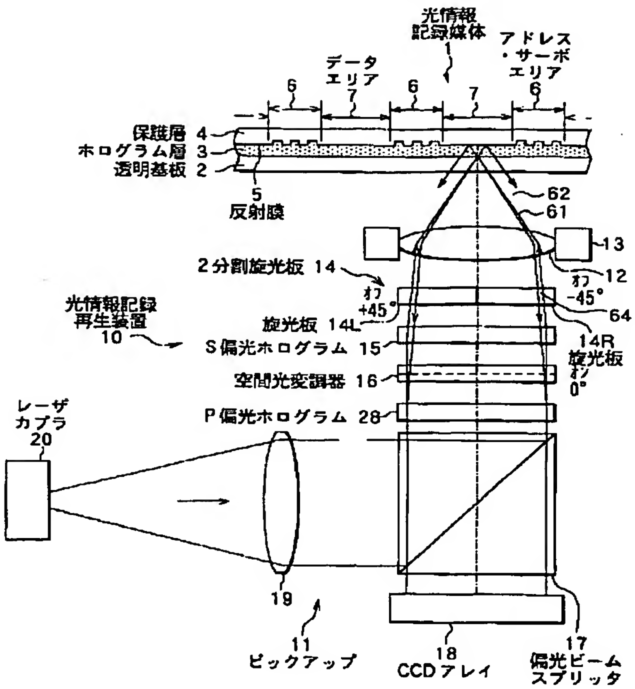
[Drawing 17]



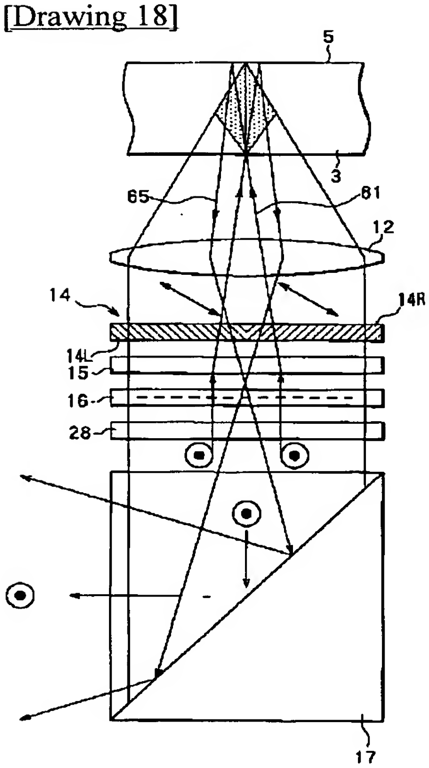
[Drawing 26]



[Drawing 13]

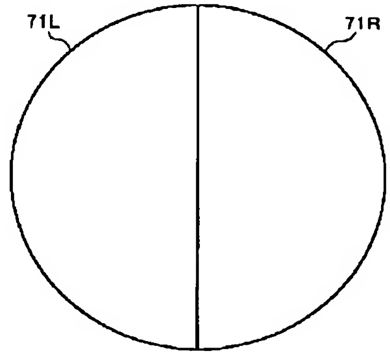


[Drawing 18]

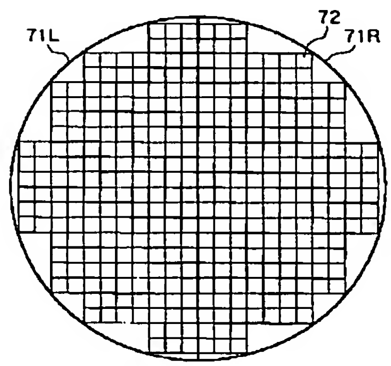


[Drawing 19]

(a)

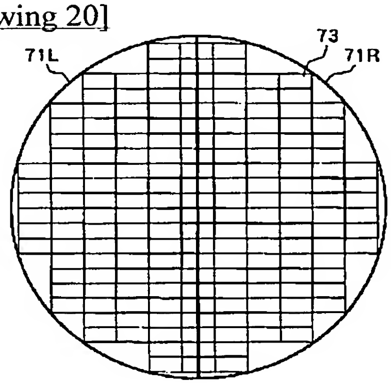


(b)

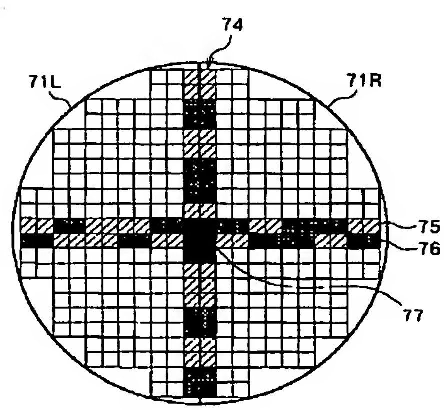


[Drawing 20]

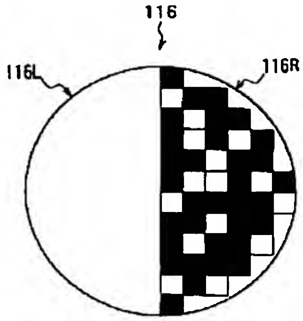
(a)



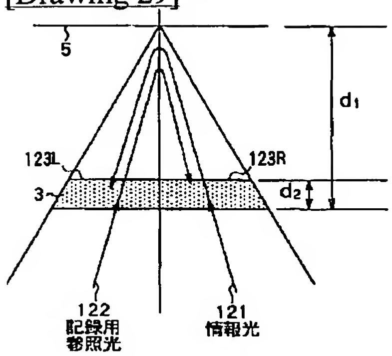
(b)



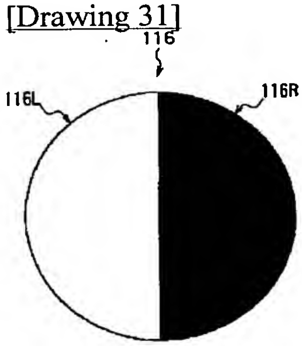
[Drawing 28]



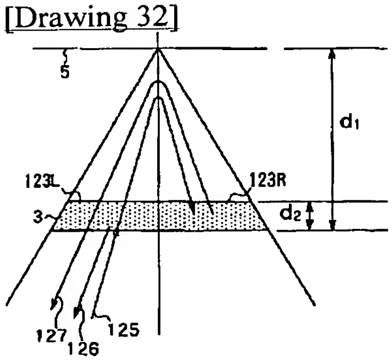
[Drawing 29]



[Drawing 31]

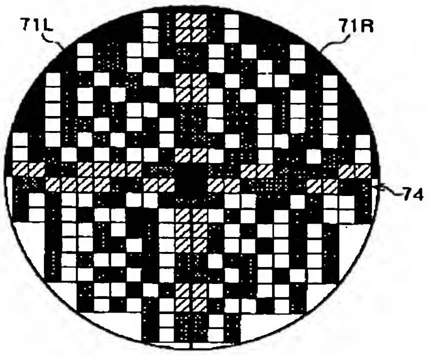


[Drawing 32]

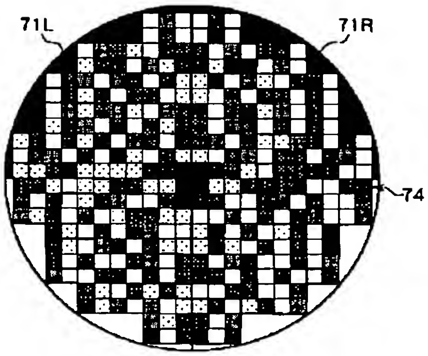


[Drawing 21]

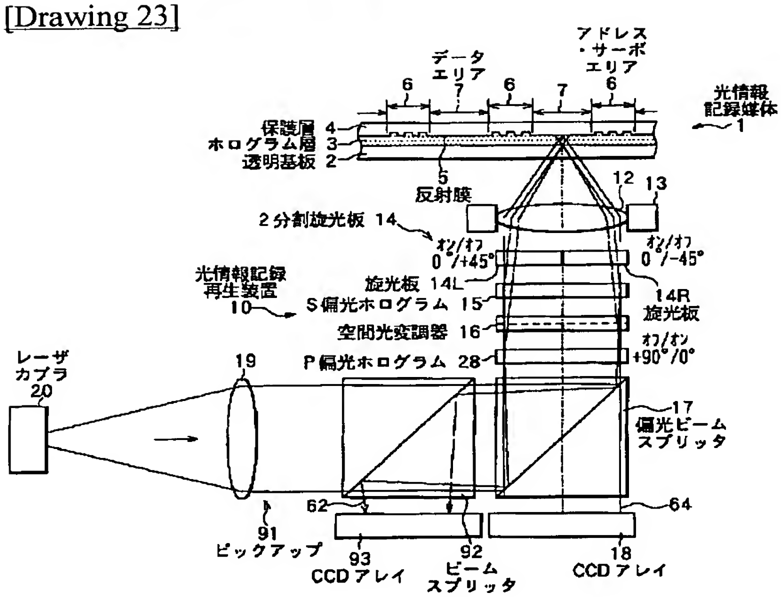
(a)



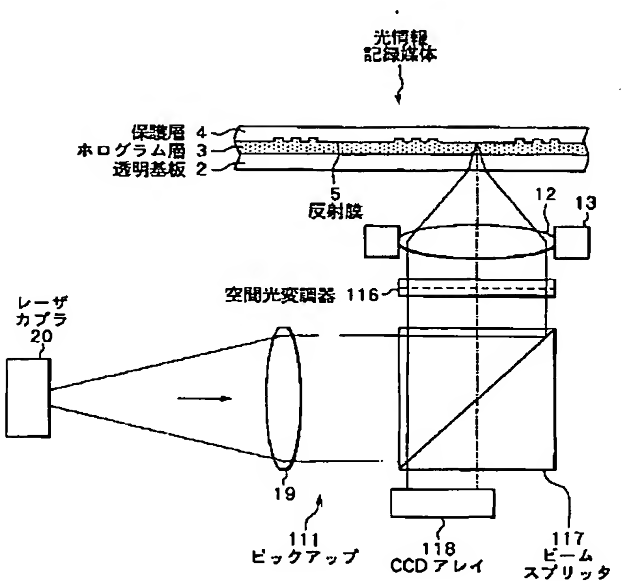
(b)



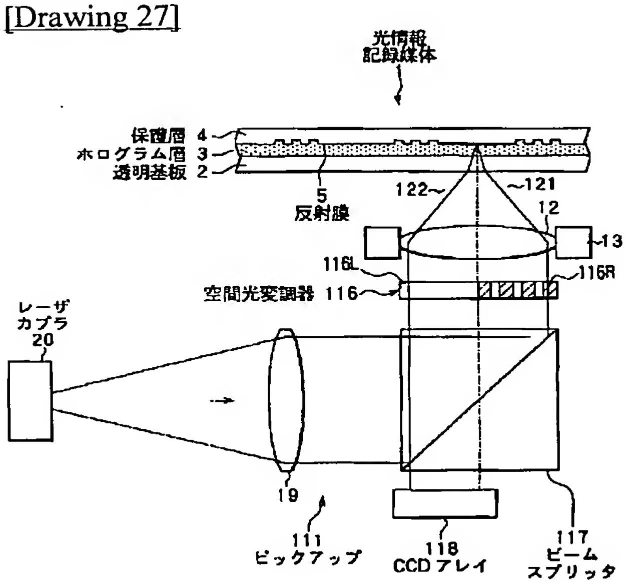
[Drawing 23]



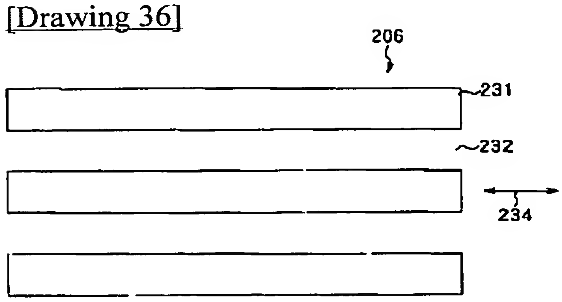
[Drawing 24]



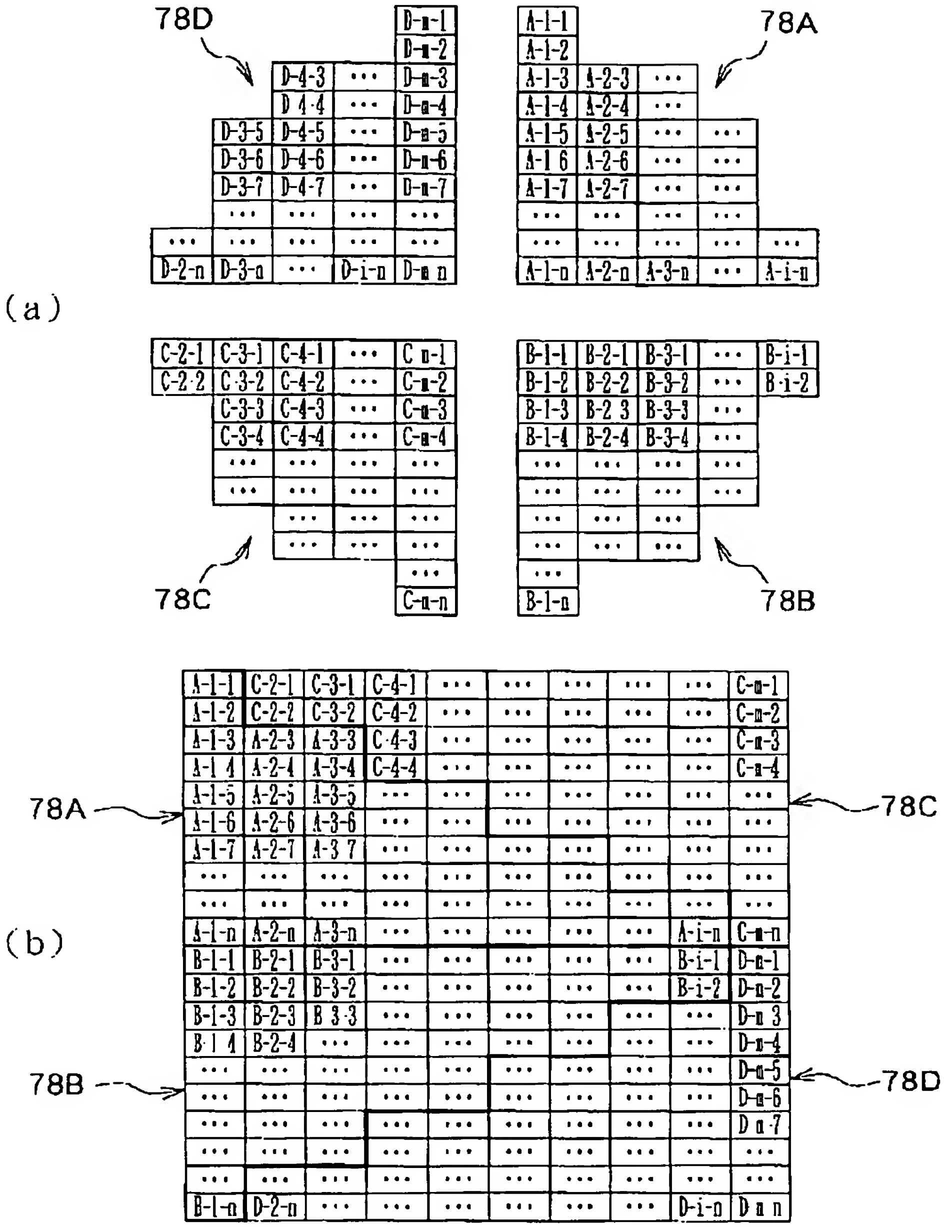
[Drawing 27]



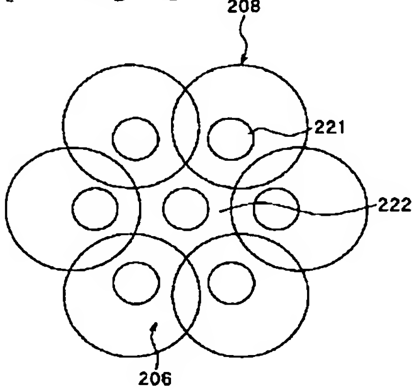
[Drawing 36]



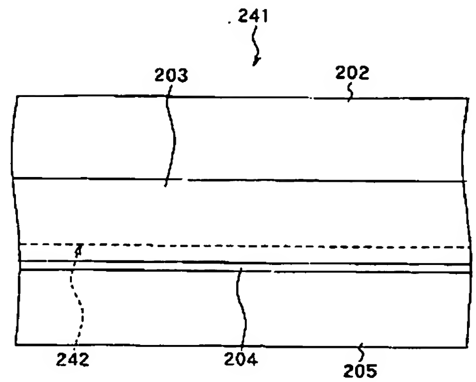
[Drawing 22]



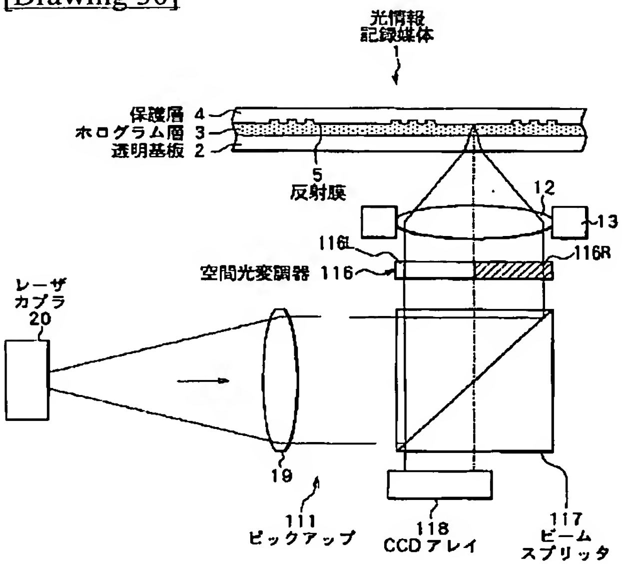
[Drawing 35]



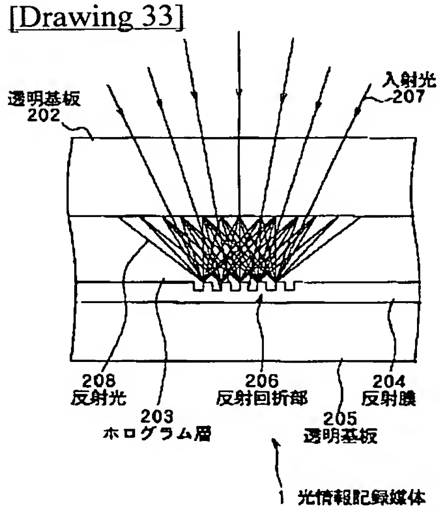
[Drawing 37]



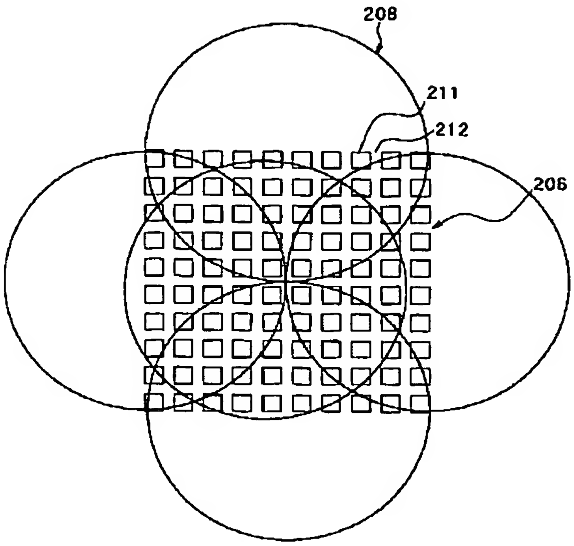
[Drawing 30]



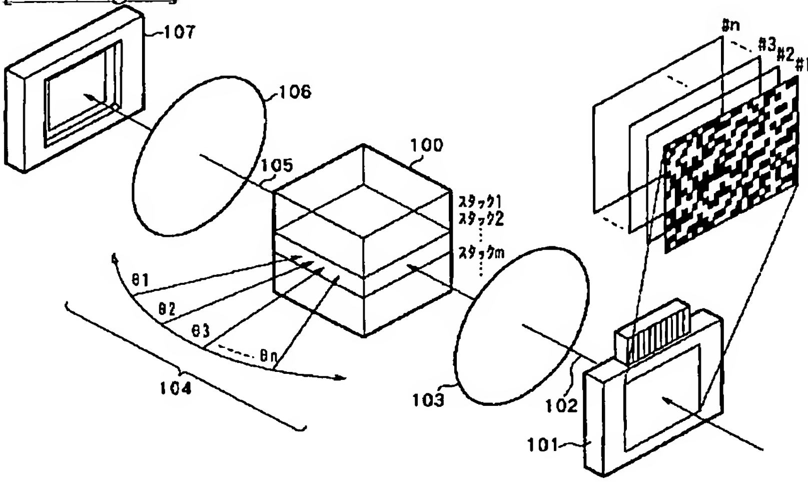
[Drawing 33]



[Drawing 34]



[Drawing 38]



[Translation done.]